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FINAL TECHNICAL REPORT

For

Support Activities to Maintain SUMS Flight Readiness

Contract No. NAS1-17399

Volume 9 of 9
Attachment C: Flight STS-40 Report
Attachment D: SUMS Software Listing

submitted to

National Aeronautics and Space Administration
Langley Research Center
Hampton, Virginia 23665-5225

by

The University of Texas at Dallas
P.O. Box 830688
Richardson, Texas 75083-0688

SUMS FINAL REPORT
CONTRACT NAS1-17399

ATTACHMENT C
REPORT FLIGHT STS 40

The SUMS was flown on Shuttle Flight STS 40 in June 1991. Columbia was launched on June 5, 1991, from Kennedy Space Center (KSC) and landed at Edwards Air Force Base, California on June 14, 1991.

This flight failed to produce science data due to water in the inlet system. The test and analysis reports are part of this attachment.

STX
ST SYSTEMS CORPORATION
28 RESEARCH DRIVE, HAMPTON, VIRGINIA 23666 • (804) 865-0214

Date: September 13, 1991

From: Edwin W. Hinson

To: Mr. Robert C. Blanchard
AB/SSD
Langley Research Center

Subject: SUMS STS-40 Flight Results

Attached is a report on the results and conclusions from reduction and analysis of SUMS STS-40 flight data. This flight failed to produce science data due to the presence of liquid water in the inlet tubing. This report closes the SUMS STS-40 analysis activity.

cc: Mr. Roy J. Duckett
SUMS Project Engineer
Vigjan, Inc.
30 Research Drive
Hampton, VA 23666

1577 Spring Hill Road
Suite 500
Vienna, VA 22182
(703) 827-6600

4400 Forbes Blvd.
Lanham, MD 20706
(301) 794-5000

7601 Ora Glenn Dr.
Suites 100 and 300
Greenbelt, MD 20770
(301) 513-1600
(301) 513-7700

109 Massachusetts Ave.
Lexington, MA 02173
(617) 862-0405

200 Decadon Drive
Suite 120
Egg Harbour Township, NJ 08232

SUMS STS-40 RESULTS

Initial inspection of the SUMS channel 47 and 48 data words during descent showed no science data. These channels contained only instrument status "fill words" having constant decimal values of 173 and 119 for channels 47 and 48, respectively. These values correspond to binary bit patterns which give the following instrument status:

Parameter	Condition
ion pump current	high
ion pump power	off
UAMS power	off
inlet pressure	ok
internal pressure	ok
program error	none
processor halt	halt
buffer overflow	ok
decode	searching
UAMS reset	release
system reset	operate
protection valve	closed
range valve	closed
inlet valve	closed

The indicated status is consistent with an internal overpressure or with a malfunction which produces an ion pump overcurrent condition, followed by the normal flight software response which turns the ion pump off, closes all valves, and executes the processor halt instruction. This state would be maintained until removal and subsequent reapplication of SUMS power at which time a power on reset would be attempted.

Initial inspection of the on-orbit SUMS data showed the same status as the descent data except the UAMS power status was on

rather than off. This result is consistent with the different command sequences issued during the two operating periods; i.e., UAMS power was applied by stored command during the on-orbit sequence and by SUMS flight software command during descent.

Further analysis of the STS-40 data was based on the assumption that the PCM channel 47 and 48 data was either incorrect as a result of a data system hardware malfunction or that the data was correct and reflected either a malfunction of the ion pump or the presence of an abnormally high pressure in the UAMS which would cause an ion pump over-current condition. Information with which to proceed with the analysis was available from the SUMS analog engineering data in PCM channel 49, from the SEADS pressure transducer mounted on SUMS and tied to channels 50 and 51, and from postflight tests of the SUMS flight hardware.

The fact that the SUMS status obtained from the fill words in channels 47 and 48 shows different values for on-orbit and descent sequences tends to discount the possibility of a data system malfunction, especially since the status is consistent with the known commanding of the instrument for the two sequences. Further proof that the instrument and data system were operating normally was found in the ion pump current monitor in channel 49 and in the measurements from the SEADS pressure transducer mounted at the SUMS inlet port. The ion pump current monitor digital output when ion pump power is off is either a one or two, which is the observed results from STS-40 for both the on-orbit and descent sequences. At a time during descent, at which the orbiter is estimated to be about 90 km altitude, the SEADS pressure

transducer starts to rise from a prior background level of approximately 2 torr as shown in Fig. 1. The rise occurs at the expected time, is of the nature expected, and is not accompanied by the corresponding rise in the ion pump current monitor output that would occur if ion pump power were on. The 2 torr constant level observed on-orbit and up to 54700 sec during descent is totally unexpected and represents a very large pressure compared with SUMS operating range of $5x10^{-5}$ to 0.5 torr. (Note: the SUMS STS-35 operation did not show a similar high gas pressure in the inlet system.)

At this point, the suspected scenario for SUMS operation during STS-40 was as follows: (1) the instrument was operating normally, (2) after power up and initialization, the flight software checked external pressure in the safe range (less than 45 torr), (3) all valves were opened, (4) ion pump power was applied, (5) flight s/w detected ion pump over-current, (6) all valves were closed, and (7) the processor halt instruction was executed. This sequence would result from an attempt to operate SUMS with the range valve open in a 2 torr environment, since the maximum operating inlet pressure under that condition would be $5x10^{-3}$ torr, or 1/400 of the measured inlet pressure. If this assumption is correct, then closure of all valves on sensing ion pump overcurrent due to high pressure would trap the contaminating gas in the inlet volume between the inlet valve and the protection valve.

A postflight test of SUMS on the portable vacuum station in Bldg. 505 at KSC was conducted to determine the concentration and composition of any trapped gas. This test produced two key spectra, one prior to opening any valves to establish the reference

background levels within the UAMS analyzer volume and one immediately after opening the protection valve to capture a sample of the trapped gas. The reference background spectra from this test is shown in Fig. 2 and shows the normal background levels observed in prior tests. Figure 3 shows the first spectra recorded after opening only the protection valve via GSE command. The instrument was turned off between these two scans in order to open the protection valve, therefore, significant AMU 28, 40, and 44 peaks produced by desorption from the filament are seen as the filament reheats. The only departure of the spectra in Fig. 3 from what is normally seen under the same condition is the very large water peak at AMU 18. The test indicates the presence of a large quantity of water vapor which is "stored" on the inlet plumbing surfaces and is desorbing at a rate almost sufficient to match the pumping rate of the UAMS. Figure 4 shows a spectra taken several scans later at which time the AMU 28, 40, and 48 peaks are seen to subside as expected, while the AMU 18 peak has decreased very little, if any.

The wiring harness connecting SUMS to the OEX data system hardware was removed from OV-102 and tested for continuity. The lead carrying the 64 khz clock signal was found to be open. The 64 khz signal is divided by 16 in SUMS electronics to provide the 4 khz clock required to operate the UAMS. Note that this signal is not associated directly with the processing and outputting of data from SUMS; rather, it is used internally by the UAMS electronics to run the UAMS logic and data processing. Absence of the clock signal causes loss of SUMS science data and causes the DECODE flag to be set to the "searching" state. No other action results. This was

confirmed by postflight tests of SUMS at UTD. These tests were conducted with a switch inserted in the 64 khz line so that the line could be opened or closed at will. The switch was opened at various times relative to SUMS power application (before and after) and it was toggled on and off while power was on. In all cases, the effect of the 64 khz clock loss was as predicted; i.e., science data was no longer seen and the DECODE flag switched to "searching." All other engineering parameters and status flags were unchanged. The system always resumed normal operation upon return of the clock signal.

The 1.0 PSI SEADS pressure transducer mounted on SUMS for the STS-40 flight was calibrated postflight at UTD. The flight unit was found to be in very close agreement with a laboratory calibrated Baratron guage up to the 1.0 torr limit of the Baratron. This result confirmed the validity of the measurements obtained from the transducer during the flight. Also, the water vapor pressure for liquid water at the flight measured temperature of 6°C in the inlet system was calculated to be about 7 torr.

In summary and conclusion, the SUMS flight hardware operated normally during the STS-40 flight. Presence of a large water vapor pressure, 2.0 torr, in the SUMS inlet was measured during flight and confirmed by postflight test and analysis. Operation of SUMS hardware as determined from recorded engineering data was consistent with detection of ion pump overcurrent, which would result from a 2.0 torr inlet pressure with range valve open, and the subsequent safing of the instrument. The broken 64 khz clock lead was not a factor in the STS-40 results, as proved by postflight ground tests.

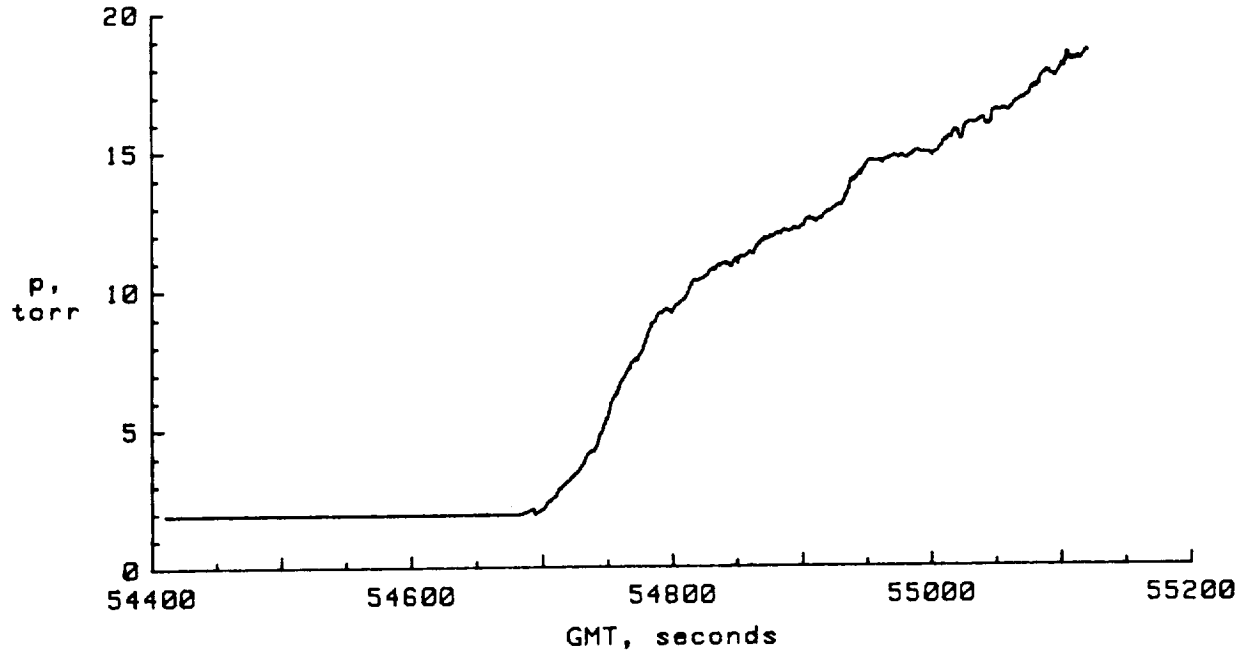

Fig. 1 Pressure measured by SEADS transducer at SUMS port during STS-40 reentry.

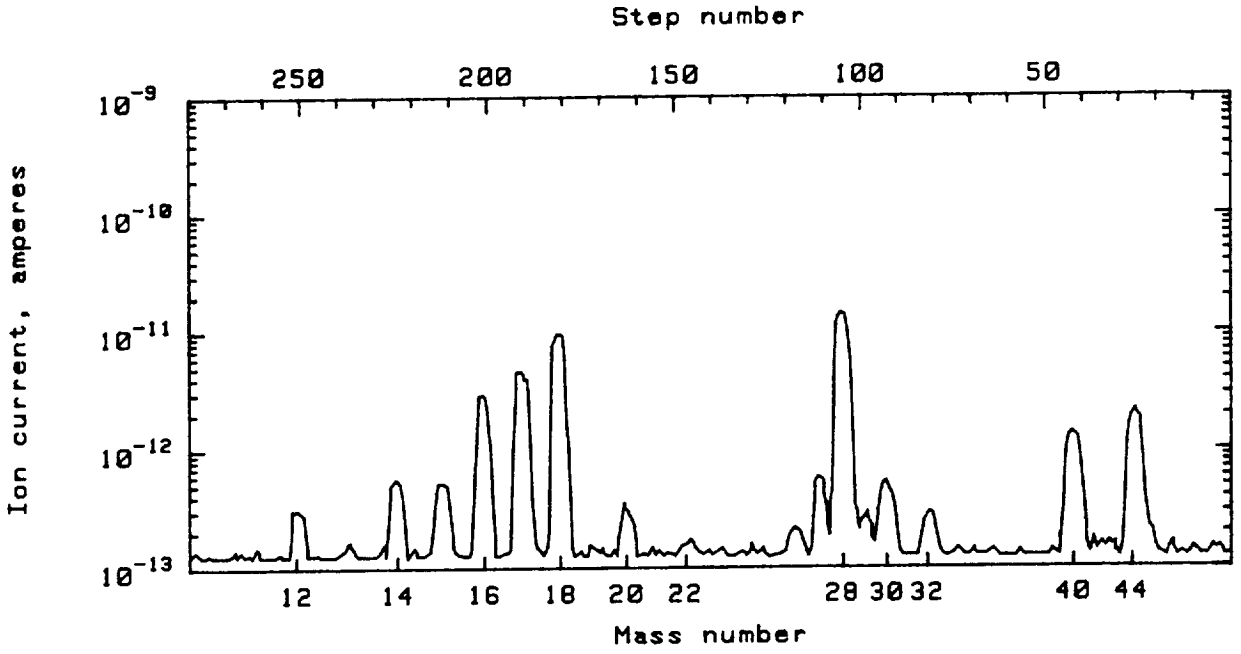

Fig. 2 SUMS spectra just before protection valve opened during postflight test.

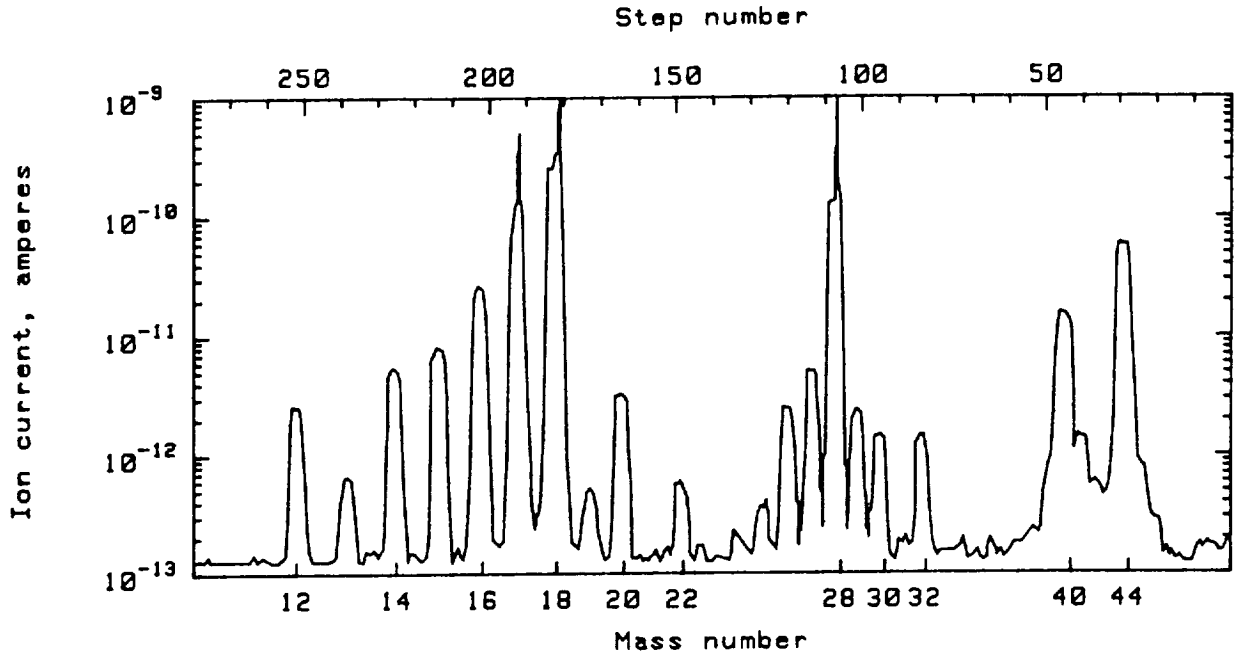

Fig. 3 SUMS spectra just after protection valve opened during postflight test.

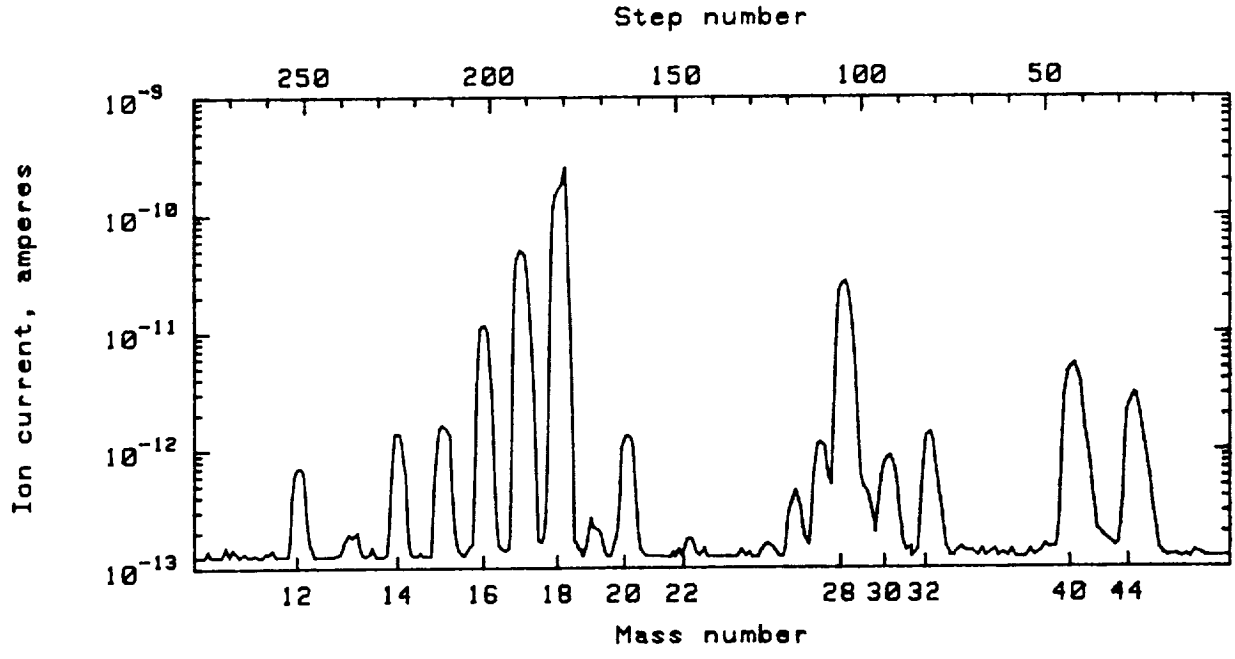

Fig. 4 SUMS spectra several scans after protection valve opened during postflight test.

DATE: September 23, 1991

FROM: Roy J. Duckett

TO: Mr. Robert C. Blanchard SSD,AB

SUBJECT: STS 40 Flight Results

I have reviewed the memo from Mr. Edwin W. Hinson and agree with the technical contents of the memo, however one point needs to be clarified. The presence of two torr water vapor in the inlet system during the flight of STS 40 and the failure to find the two torr pressure in post flight testing. The post flight testing is consistent with liquid water in the inlet system during the STS 40 flight. Once the Inlet valve is closed , the liquid water is no longer in equilibrium with the water vapor and the pressure in the tube between the inlet valve and the protection valve is reduced by water being adsorbed in the walls of the tubing. Also once on the ground and connected to the external vacuum system all liquid water in the inlet system would be pumped out. Therefore high water vapor would be expected to be found between the valves , but not a two torr levels.

Roy J. Duckett

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ATTACHMENT D
SUMS SOFTWARE LISTING

(1) GPIO_DATIN:

GPIO_DATIN is a general program for receiving data from the SUMS instrument. The use of this program requires the SUMS Ground Support Equipment and a General Purpose Input Output card in the HP computer. In general this program receives data from the SUMS in 16 bit parallel format, and stores the data on disk.

(2) SC_SUMS:

SC_SUMS: is a program to analyze data stored by GPIO_DATIN. Data used by this program is assumed to be stored in a format where scans are in order i.e. (1, 2, 3, 4), also it is assumed that the pressure applied to SUMS is Static.

(3) DC_SUMS:

DC_SUMS is a program to analyze data stored by GPIO_DATIN. Data used by this program may be stored in any order, since it performs analysis on individual scans. It is assumed that the pressure is changing during the data period.

(4) SUMS 90:

SUMS is a program to analyze SUMS flight data, SUMS produces plots of the spectra and data files of the peaks (44, 40, 32, 30, 28, 22, 20, 18, 16, 14, 12). In the peak mode, peaks may be either picked by the program or selected by the operator.

(5) PLOT8:

PLOT8 is a general plotting program to plot data and perform polynomial regression analysis of the data.

(6) SUMSDISP90:

SUMSDISP90 is a program to display SUMS spectra plots on the CRT and to replay the spectra in sequence.

(7) READPEAKS:

READPEAKS is a program which reads the peak data stored by SUMS. This program plots the peaks as a function of time, and generates data files for the individual peaks as a function of the time the peak data was obtained.

(8) PRTALOGI:

PRTALOGI is a program which uses the data from the curve fit of altitude and peak currents. The output of the program is, SNAPSHOT CURRENTS, snapshot currents are currents calculated from the equation of the same time and/or altitude.

ATTACHMENT D - SUMS SOFTWARE LISTING

(1) GPIO_DATIN:

```
10! RE-STORE "GPIO_DATIN"
20    !RJD   REVISION       8/22/88
30    OPTION BASE 1
40    Config(Program$,Data$)
50    DISP
60    DISP "MASS STORAGE SET UP OK";
70    Yesno(R5)
80    ON R5 GOTO 90,40,50
90    PRINTER IS 1
100   PRINT CHR$(12)
110   DISP
120   DISP "IS DATE CORRECT AND TIME CORRECT";
130   PRINT DATE$(TIMEDATE);"    ";TIME$(TIMEDATE)
140   Yesno(R5)
150   ON R5 GOTO 240,160,120
160   DISP "INPUT DATE FORM 15 DEC 86";
170   INPUT Dmy$
180   SET TIMEDATE FNDate(Dmy$)
190   DISP
200   DISP "INPUT 24 HOUR CLOCK FORM  14:25:36";
210   INPUT Hms$
220   SET TIME FNTime(Hms$)
230   PRINT TIME$(TIMEDATE);"     ";DATE$(TIMEDATE)
240   PEN 0
250   PLOTTER IS 3,"INTERNAL"
260   PEN 1
270   ALPHA ON
280   GRAPHICS OFF
290   DISP
300   DISP "INPUT BARTRON RANGE MULTIPLIER POSITION";
310   INPUT Bm
320    IF Bm=.01 OR Bm=.1 OR Bm=1 THEN
330    GOTO 370
340    ELSE
350    GOTO 290
360     END IF
370   IF Bm=1 THEN Divider=10
380   IF Bm=.1 THEN Divider=100
390   IF Bm=.01 THEN Divider=1000
400   BEEP
410   DIM Info$[80],Mdy$[11],Hmin$[9],Desc$[80]
420   DIM Dat(21)
430   GOSUB Info
440   PRINT Info$[1,55]
450   PRINT Info$[56,80]!
460   !INFO$[56,63]   TIME      INFO$[71,78] DATE
470   PRINT Dat(*)
480   PRINT "PRESS CONT WHEN READY TO TAKE DATA"
490   PAUSE
500   WAIT 1
510   BEEP
520   DISP "INPUT # OF MASS SCANS ";
530   INPUT Scan_select
540   ALLOCATE INTEGER Scan(Scan_select,448),Eng(12)
550   ALLOCATE Lsci(72),Hsci(360),Me(2,12)
560   DISP
570   DISP "INPUT NUMBER OF PRESS PT PER SCAN";
580   INPUT Pp
590   ALLOCATE Press(Scan_select*Pp,2)
600   Nn=Scan_select*Pp
```

```
610   Pt=INT(5000/Pp)
620   REMOTE 726
630   OUTPUT 726;"F0R3P0S1X"
640   OUTPUT 726;"T2I";Nn;"Q";Pt;"X"
650   GOSUB Gpio_read
660   GOSUB Data_store
670   GOTO End
680 Gpio_read: !
690 Reset:  !
700         PRINT "I AM NOW WORKING ON THE DATA INPUT"
710         PRINT "DO NOT DISTURB"
720            Scan_count=0
730            ASSIGN @Gpio TO 12
740            GOTO Nextword
750 Reset_scan:  !
760              IF Trig=1 THEN 790
770              TRIGGER 726
780              Trig=1
790            Science=0
800            Inst_status=0
810            Fill_count=0
820            Scan_count=Scan_count+1
830 Nextword: !
840            ENTER @Gpio USING "#,W";Data_word
850          IF Data_word>-1 THEN Id_test
860 Inststatus:  !
870            IF Data_word=Inst_status THEN GOTO Nextword
880            IF Inst_flag<>2 THEN GOTO Nextword
890            Inst_status=Data_word
900            Fill_count=Fill_count+1
910            Scan(Scan_count,444+Fill_count)=Data_word
920            GOTO Nextword
930 Id_test: !
940          IF Inst_flag=2 THEN Sciencedata
950            IF Data_word=747 THEN Inst_flag=1     !FIND FIRST ID
960            IF Data_word=747 THEN Nextword
970            IF Data_word=656 AND Inst_flag=1 THEN Inst_flag=2  !FOUND SECOND
ID
980       IF Inst_flag=2 THEN Reset_scan                          !   COUNTER FOR NUMB
ER OF SCANS
990    !   T$=TIME$(TIMEDATE)
1000    !  Scan(Scan_count,447)=VAL(T$[4,5])
1010     ! Scan(Scan_count,448)=VAL(T$[7,8])
1020           GOTO Nextword
1030 Sciencedata:!
1040            Science=Science+1    !COUNTER FOR SCIENCE WORDS
1050           Scan(Scan_count,Science)=Data_word      !STORE SCIENCE DATA
1060           IF Science=444 AND Scan_count=Scan_select THEN Done
1070           IF Science=444 THEN Inst_flag=0
1080            GOTO Nextword
1090 Done:!    !RETURN  TO MAIN PROGRAM
1100      PRINT "IHAVE THE DATA WITH NO ERRORS"
1110      FOR I=1 TO Scan_select
1120      PRINT "INTERLACE NUMBER  ";BINAND(Scan(I,1),255)-103
1130      NEXT I
1140      OUTPUT 726;"G1B1X"
1150      FOR I=1 TO Scan_select*Pp
1160      ENTER 726;Press(I,2)
1170      Press(I,2)=Press(I,2)/Divider
1180      Press(I,1)=(I-1)*5/Pp
```

```
1190       NEXT I
1200       FOR I=1 TO Scan_select*Pp
1210       PRINT "Time & Pressure IN TORR IS    ";Press(I,1),Press(I,2)
1220       NEXT I
1230       RETURN
1240 Data_store:!
1250             ! STRING     1 BYTE PER CHAR (+1 IF ODD) + 4BYTE OVERHEAD
1260             ! INTEGER    2 BYTE PER NUMBER
1270             ! REAL       8 BYTE PER NUMBER
1280             PRINT "DO YOU WISH TO STORE THIS DATA"
1290             Yesno(R5)
1300             ON R5 GOTO 1310,2070,1280
1310             MASS STORAGE IS Data$
1320  !STORE SUMS DATA BY SETS OF DATA
1330  !IN 16 BIT FORMAT
1340  BEEP
1350   PRINT "NUMBER OF SCANS IN MEMORY IS ";Scan_count
1360   PRINT "INTERLACE 1 IS IN SCANS";
1370   FOR I=1 TO Scan_count
1380   IF Scan(I,1)<>1128 THEN 1400
1390   PRINT I
1400   NEXT I
1410   PRINT
1420   PRINT "INPUT BEGAINING AND END SCAN TO STORE (N1,N2) "
1430  INPUT Num1,Num2
1440  IF Num1>Num2 THEN 1340
1450  File_test=Num2-Num1+1
1460  IF INT(File_test/2)*2=File_test THEN Filesize=INT(3.5*File_test)+1
1470  IF INT(File_test/2)*2<>File_test THEN Filesize=INT(3.5*File_test)+2
1480  PRINT "INPUT NAME OF FILE NAME (10 CHAR OR LESS) "
1490  INPUT File$
1500  Length=LEN(File$)
1510  IF Length<=8 THEN 1570
1520  PRINT "TOO LONG TRY AGAIN"
1530  BEEP
1540  WAIT .5
1550  BEEP
1560  GOTO 1480
1570  CREATE BDAT File$,Filesize,256
1580  IF Num2-Num1+1=Scan_count THEN 1680
1590  IF Num1=1 THEN 1670
1600  J=1
1610  FOR Sig_1=Num1 TO Num2
1620  FOR Out=1 TO 448
1630  Scan(J,Out)=Scan(Sig_1,Out)
1640  NEXT Out
1650  J=J+1
1660  NEXT Sig_1
1670  REDIM Scan(Num2-Num1+1,448)
1680  ASSIGN @Ab TO File$
1690  OUTPUT @Ab;Info$
1700  OUTPUT @Ab;Dat(*)
1710  OUTPUT @Ab;Scan(*)
1720  DISP
1730  DISP "STORE PRESS DATA";
1740  Yesno(R5)
1750  ON R5 GOTO 1760,1820,1720
1760  File$="P_"&File$
1770  L=LEN(File$)
1780  IF L>10 THEN File$=File$[L-9,L]
```

```
1790  CREATE BDAT File$,Nn,16
1800  ASSIGN @Ab TO File$
1810  OUTPUT @Ab;Press(*)
1820  MASS STORAGE IS Program$
1830   RETURN
1840 Info: !
1850       DISP
1860                 DISP "INPUT TEST DESCRIPTION 55 CHAR OR LESS";
1870                 INPUT Desc$
1880                 Length=LEN(Desc$)
1890                 IF Length<=55 THEN 1920
1900                 PRINT "TOO LONG TRY AGAIN"
1910                 GOTO 1860
1920                 DISP
1930                 Desc$=Desc$&RPT$(" ",55-Length)
1940                 Info$=Desc$&TIME$(TIMEDATE)&"    "&DATE$(TIMEDATE)
1950                 MAT Dat= Dat*(0)
1960                 FOR I=1 TO 21
1970                 DISP
1980                 DISP "Input Analog Monitor  Data Point # ";I;
1990                 INPUT Dat(I)
2000                 NEXT I
2010                 BEEP
2020                 PRINT "RETURN SWITCH TO POSITION 1"
2030                 WAIT .5
2040                 BEEP
2050                 RETURN
2060 End:           !
2070               BEEP
2080               PRINT "END OF DATA TAKING AND STORAGE"
2090               PRINT "DATA HAS BEEN STORED ON ";File$
2100               DISP
2110               DISP "WANT DATA ANALYSIS";
2120               Yesno(R5)
2130               ON R5 GOTO 2140,2150,2110
2140               LOAD "SC_SUMS",1
2150               PEN 0
2160               PLOTTER IS 3,"INTERNAL"
2170               PRINTER IS 1
2180               END
2190  SUB Yesno(R5)
2200  CONTROL KBD,2;1
2210  LOOP
2220  ON KEY 0 LABEL "YES" GOTO 2330
2230  ON KEY 1 LABEL "" GOTO 2210
2240  ON KEY 2 LABEL "" GOTO 2210
2250  ON KEY 3 LABEL "" GOTO 2210
2260  ON KEY 4 LABEL "NO" GOTO 2360
2270  ON KEY 5 LABEL "" GOTO 2210
2280  ON KEY 6 LABEL "" GOTO 2210
2290  ON KEY 7 LABEL "" GOTO 2210
2300  ON KEY 8 LABEL "REPEAT ?" GOTO 2390
2310  ON KEY 9 LABEL "" GOTO 2210
2320  END LOOP
2330  R5=1
2340  OFF KEY
2350  GOTO 2410
2360  R5=2
2370  OFF KEY
2380  GOTO 2410
```

```
2390  R5=3
2400  OFF KEY
2410  SUBEND
2420     SUB Config(Program$,Data$)
2430     DISP
2440     CONTROL KBD,2;1
2450     DISP "SELECT OPTION";
2460     LOOP
2470     ON KEY 0 LABEL "PROGRAM" GOTO 2450
2480     ON KEY 1 LABEL "INT,0" GOTO Pinternal0
2490     ON KEY 2 LABEL "INT,1" GOTO Pinternal1
2500     ON KEY 3 LABEL "700,0" GOTO Php0
2510     ON KEY 4 LABEL "700,1" GOTO Php1
2520     ON KEY 5 LABEL "DATA " GOTO 2460
2530     ON KEY 6 LABEL "INT,0" GOTO Dinternal0
2540     ON KEY 7 LABEL "INT,1" GOTO Dinternal1
2550     ON KEY 8 LABEL "700,0" GOTO Dhp0
2560     ON KEY 9 LABEL "700,1" GOTO Dhp1
2570     END LOOP
2580 Pinternal0:     !
2590                 Program$=":INTERNAL4,0"
2600                 GOTO Subend
2610 Pinternal1:                !
2620                Program$=":INTERNAL4,1"
2630                GOTO Subend
2640 Php1:         Program$=":,700,1"
2650      GOTO Subend
2660 Php0:        !
2670              Program$=":,700,0"
2680              GOTO Subend
2690 Dinternal0:    !
2700                Data$=":INTERNAL4,0"
2710                GOTO Subend
2720 Dinternal1: !
2730              Data$=":INTERNAL,4,1"
2740              GOTO Subend
2750 Dhp1:         Data$=":,700,1"
2760              GOTO Subend
2770 Dhp0:!
2780            Data$=":,700,0"
2790            GOTO Subend
2800 Subend: !
2810          BEEP
2820          Flag=Flag+1
2830          IF Flag=2 THEN 2880
2840          DISP
2850     !    CONTROL KBD,2;2
2860          DISP "SELECT NEXT OPTION";
2870          IF Flag<=1 THEN 2460
2880          PRINT "PROGRAM MSI IS ";Program$
2890          PRINT "DATA MSI IS ";Data$
2900          SUBEND
2910          SUB Aclear
2920          OUTPUT 2 USING "#,B";255,75
2930          SUBEND
2940  !   "DATE_TIME"   ************************************************************
*
2950 DEF FNTime$(Now) ! GIVEN SECONDS RETURN HOUR,MIN SEC
2960 Now=INT(Now) MOD 86400
2970 H=Now DIV 3600
```

```
2980 M=Now MOD 3600 DIV 60
2990 S=Now MOD 60
3000 OUTPUT T$ USING "#,ZZ,K";H,":",M,":",S
3010 RETURN T$
3020 FNEND
3030 DEF FNTime(T$) ! GIVEN HH:MM:SS RETURN SECONDS
3040 ON ERROR GOTO Err
3050 ENTER T$;H,M,S
3060 RETURN (3600*H+60*M+S) MOD 86400
3070 Err:OFF ERROR
3080     RETURN TIMEDATE MOD 86400
3090     FNEND
3100  DEF FNDate$(Seconds)  ! GIVEN SECONDS RETURN DD MM YYYY
3110  DATA JAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT,NOV,DEC
3120  DIM Month$(1:12)[3]
3130  READ Month$(*)
3140  Julian=Seconds DIV 86400-1721119
3150  Year=(4*Julian-1) DIV 146097
3160  Julian=(4*Julian-1) MOD 146097
3170  Day=Julian DIV 4
3180  Julian=(4*Day+3) DIV 1461
3190  Day=(4*Day+3) MOD 1461
3200  Day=(Day+4) DIV 4
3210  Month=(5*Day-3) DIV 153    !  MONTH
3220  Day=(5*Day-3) MOD 153
3230  Day=(Day+5) DIV 5          ! DAY
3240  Year=100*Year+Julian
3250  IF Month<10 THEN
3260  Month=Month+3
3270  ELSE
3280  Month=Month-9
3290  Year=Year+1
3300  END IF
3310  OUTPUT D$ USING "#,ZZ,X,3A,X,4Z";Day,Month$(Month),Year
3320  RETURN D$
3330  FNEND
3340  DEF FNDate(Dmy$)    ! GIVEN DD, MMM,  YYYY RETURN SECONDS
3350  DATA JAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT,NOV,DEC
3360  DIM Month$(1:12)[3]
3370  READ Month$(*)
3380  ON ERROR GOTO Err
3390  I$=Dmy$&"   "
3400  ENTER I$ USING "DD,4A,5D";Day,M$,Year
3410  IF Year<100 THEN Year=Year+1900
3420  FOR I=1 TO 12
3430  IF POS(M$,Month$(I)) THEN Month=I
3440  NEXT I
3450  IF Month=0 THEN Err
3460  IF Month>2 THEN
3470  Month=Month-3
3480  ELSE
3490  Month=Month+9
3500  Year=Year-1
3510  END IF
3520  Century=Year DIV 100
3530  Remainder=Year MOD 100
3540  Julian=146097*Century DIV 4+1461*Remainder DIV 4+(153*Month+2) DIV 5+Day+1
721119
3550  Julian=Julian*86400
3560  Seconds=Julian
```

```
3570  IF Julian<2.08662912E+11 OR Julian>=2.143252224E+11 THEN Err
3580  RETURN Julian ! RETURN JULIAN DATE IN SECONDS
3590 Err: OFF ERROR
3600      PRINT "ERROR"
3610      RETURN TIMEDATE  ! RETURN CURRENT DATE
3620      FNEND
```

ATTACHMENT D - SUMS SOFTWARE LISTING

(2) SC_SUMS:

```
10 !    RE-STORE "SC_SUMS"
20 ! NOTE USE THIE PROGRAM TO CLEAN UP THE PROGRAM AND REMOVE UNNECESSARY LINES
30 ! NOTE THIS VERSION USED WITH DATA FROM STATIC CAL
40 ! IT ASSUMES 4 SCAN IN ORDER OF 1,2,3,4
50 ! ALSO DATA FROM BATRON IN PRESSURE FILE
60    !RJD   REVISION     9/15/88
70    OPTION BASE 1
80    GCLEAR
81    STATUS KBD,9;Keyb
82    IF (BIT(Keyb,5)=1) THEN CALL Config320(Program$,Data$)
83    IF (BIT(Keyb,5)=0) THEN CALL Config36(Program$,Data$)
90    DIM Cat$(1)[80],Image$[80]
100             INTEGER Scan(4,448),Eng(4,12)
110   DIM Lsci(4,72),Hsci(4,360),Me(2,11),Curr(36),Peaks(11,2),Lut(16,32),Lpeaks
(3)
120   ASSIGN @Ab TO "LUT"
130   ENTER @Ab;Lut(*)
140   DIM Info$[80]
150   DIM Dat(21)
160   DISP
170   Printer=1
180   PRINTER IS Printer
190   PRINT CHR$(12)    ! FF CLEARS SCREEN
210   PEN 0
220   PLOTTER IS 3,"INTERNAL"
230   PEN 1
240   GINIT
250   ALPHA ON
260   GRAPHICS OFF
270   BEEP
280   MASS STORAGE IS Data$
281   CAT
290   BEEP
300   DISP
310   DISP "INPUT FILE NAME";
320   INPUT File$
330   Rec_num=15
340   File$="P_"&File$
350   CAT TO Cat$(*);SELECT File$,NO HEADER
360   N_press=VAL(Cat$(1)[38,45])
370   ALLOCATE Press(N_press,2)
380   MAT Press= (0)*Press
390   Scan_count=4
395    GOSUB Disk_data
396    MASS STORAGE IS Program$
400   DISP "PRINTER (P) OR SCREEN (S) ";
410   INPUT C$
420   IF C$[1,1]="S" OR C$[1,1]="s" THEN 460
430   Printer=701
440   PRINTER IS Printer
450   DISP
460   DISP "PLOTTER (P) OR SCREEN (S) ";
470   INPUT C$
480   IF C$[1,1]="S" OR C$[1,1]="s" THEN 580
490   Plotter=705
500   DISP
510   DISP "SELECT PEN";
520   INPUT Pen
530   PEN Pen
540   PLOTTER IS 705,"HPGL"
```

```
550   PRINTER IS 705
560   PRINT "VS10"
570   PRINTER IS Printer
580 !  GOSUB Disk_data
590    Ave_press=0
600    FOR I=1 TO N_press
610    Ave_press=Ave_press+Press(I,2)
620    NEXT I
630    Ave_press=Ave_press/N_press
640   GOSUB Scisep
650   GOTO End
660 Scisep:           !
670                   FOR Sn=1 TO 4
680                   Engc=0
690                   FOR I=1 TO 12
700                   Eng_test=INT(Scan(Sn,I)/256)
710                   IF Eng_test<>4 THEN 740
720                   Engc=Engc+1
730                      Eng(Sn,I)=BINAND(Scan(Sn,I),255)
740                   NEXT I
750         W=Eng(Sn,1)-103  !************************************************
760         IF W>0 AND W<5 THEN 790
770         PRINT "INTERLACE NUMBER DOES NOT CHECK"
780         PAUSE
790         Highc=0
800         Lowc=W+13
810         Lown=0
820         FOR I=13 TO Science
830         Rr=0
840          IF I=Lowc THEN 900
850          Highc=Highc+1
860          Sig=BINAND(Scan(Sn,I),31)
870          Ran=BINAND(Scan(Sn,I),480)/32
880          Hsci(Sn,Highc)=Lut(Ran+1,Sig+1)
890          GOTO 950
900       Lown=Lown+1 !         LOW MASS HERE
910          Sig=BINAND(Scan(Sn,I),31)
920          Ran=BINAND(Scan(Sn,I),480)/32
930          Lsci(Sn,Lown)=Lut(Ran+1,Sig+1)/2
940       Lowc=Lowc+6
950       NEXT I
960     ! IF Science<>444 THEN GOSUB Printout
970     NEXT Sn
980     GOSUB Graphplot
990                   RETURN
1000   !"GRAPHPLOT"
1010 Graphplot: !*************************************************************
1020              GCLEAR
1030              ALPHA OFF
1040              GRAPHICS ON
1050 DEG
1060 !  Lmass=1     ! THIS SELECTS THE LOW MASS PLOT OPTION  REMOVE !
1070 X1=280                          !360   NOTE X1 USED IN STEP LABEL ETC
1080 X2=0
1090 X5=X1+72*(Lmass=1)  !IF SELECT LOW MASS PLOT X5=X1+72
1100 X3=X5+.1*ABS(X2-X5)
1110 X4=X2-.1*ABS(X2-X5)
1120 Y1=LGT(1.E-13)
1130 Y2=LGT(1.E-9)
1140 Y3=Y1-.1*ABS(Y2-Y1)
```

```
1150 Y4=Y2+.1*ABS(Y2-Y1)
1160 WINDOW X3,X4,Y3,Y4
1170 CLIP X5+(.05*ABS(X2-X5)),X2-(.05*ABS(X2-X5)),Y1-(.05*ABS(Y2-Y1)),Y2+(.05*AB
S(Y2-Y1))
1180! CLIP ON
1190  PENUP
1200  DIM A$[80],B$[80]
1210  A$="STEP NUMBER"
1220  B$="ION CURRENT IN AMPERE"
1230  MOVE X5,Y1
1240  DRAW X5,Y2
1250  DRAW X2,Y2
1260  DRAW X2,Y1
1270  DRAW X5,Y1
1280  J=1
1290  FOR X=X5 TO X2 STEP X2-X5
1300  FOR Y=Y1 TO Y2-1 STEP 1
1310! MOVE X,Y    ! DRAW DECADE LINES
1320! DRAW X2,Y   !DRAWS DECADE LINES
1330  FOR I=1 TO 10 STEP 1
1340  MOVE X,Y+LGT(I)
1350  IPLOT .01*J*(X2-X5),0,1
1360  IPLOT -.01*J*(X2-X5),0,1
1370  IF I<10 THEN 1400
1380  IPLOT J*.04*(X2-X5),0,1
1390  IPLOT J*(-.04)*(X2-X5),0,1
1400  NEXT I
1410  NEXT Y
1420  PENUP
1430  J=-1
1440  NEXT X
1450  FOR I=Y1 TO Y2 STEP 1
1460  MOVE X5-.045*(X2-X5),I-.015*(Y2-Y1)
1470  CLIP OFF
1480  LORG 6
1490  CSIZE 2.5,.6
1500  LABEL "10"
1510  MOVE X5-.016*(X2-X5),I
1520  LORG 5
1530  LABEL INT(I)
1540  CLIP ON
1550  NEXT I
1560  CLIP OFF
1570 MOVE X5-(X2-X5)*.100,(Y2+Y1)/2
1580 LDIR 90                          !DIRECTION OF YAXIS  NAME
1590 CSIZE 4,.6                       !SIZE OF YAXIS MAME
1600 LORG 6                           !CENTERS AND LOCATES YAXIS NAME
1610  LABEL (B$)
1620  LORG 1                          !NORMAL VALUE FOR LORG
1630  PENUP
1640  LDIR 0                          !NORMAL VALUE FOR LDIR
1650! GOTO 630  ! BY PASS LABEL STEP
1660  FOR I=0 TO X1 STEP 10
1670  MOVE I,-9
1680  IPLOT 0,-.05
1690  IPLOT 0,+.05
1700  NEXT I
1710  CSIZE 3
1720  LORG 5
1730  FOR I=50 TO X1 STEP 50
```

```
1740  MOVE I,-9.00
1750  IPLOT 0,-.10
1760  IPLOT 0,+.10
1770  MOVE I,-8.85
1780  LABEL I
1790  NEXT I
1800  MOVE (X2+X1)/2,Y2+.105*(Y2-Y1)
1810  CSIZE 3,.6                              !SIZE OF XAXIS NAME
1820  LORG 6                                  !CENTERS AND LOCATES XAXIS NAME
1830  LABEL Info$[1,20]&"        "&Info$[50,80]
1840  MOVE 150,-9.2
1850  LABEL USING "35A,MD.DDDE";"AVERAGE PRESSURE IS    ",Ave_press
1860  LORG 3
1870  MOVE 250,-9.5
1880  LABEL USING "15A";"DATA FROM  ";File$[3,11]
1890  ! "STEP_AMU"
1900  ! CAL OF STEP LOCATIONS FROM TWO KNOWN STEPS AND AMU
1910 !DISP "INPUT STEP,1 AMU 1";
1920 !INPUT Step1,Amu1
1930 Step1=27.5
1940 Amu1=44
1950 !DISP "INPUT STEP 2,AMU 2";
1960 !INPUT Step2,Amu2
1970 Step2=251.5
1980 Amu2=12
1990  A=(LGT(Amu2)-LGT(Amu1))/(Step2-Step1)
2000  B=LGT(Amu1)-A*Step1
2010 !PRINT "LGT(AMU)= SLOPE *STEP+CONSTANT"
2020 !PRINT "SLOPE = ";A;"    CONSTANT = ";B
2030 !PRINT
2040 !PRINT "AMU","STEP","STEP RANGE"
2050 LORG 5
2060 CSIZE 3
2070  FOR I=1 TO 11
2080  READ Amu
2090  DATA 44,40,32,30,28,22,20,18,16,14,12
2100  Step=INT((LGT(Amu)-B)/A+.5)
2110  Me(1,I)=Amu
2120  Me(2,I)=Step
2130 !PRINT Amu,Step,Step-2;"-";Step+2
2140 MOVE Step,Y1
2150  IPLOT 0,+.05
2160  IPLOT 0,-.05
2170  MOVE Step,-13.1
2180  LABEL Amu
2190  NEXT I
2200  RESTORE
2210  CSIZE 5
2220  LORG 4
2230  MOVE (X1-X2)/2,Y1-.4
2240  LABEL "MASS NUMBER"
2250  MOVE 0,-12.9   !LGT(1.24E-13)
2260  FOR I=1 TO X1
2270  DRAW I,LGT(Hsci(1,I))
2280  DRAW I+.25,LGT(Hsci(2,I))
2290  DRAW I+.5,LGT(Hsci(3,I))
2300  DRAW I+.75,LGT(Hsci(4,I))
2310  NEXT I
2320! DUMP GRAPHICS #701
2330  IF Lmass=0 THEN GOTO Bypass    !BY PASS LOW MASS PLOT
```

```
2340 Lowmass:  !
2350  MOVE X1,-13.2   !LGT(6.2E-14)
2360  FOR I=1 TO 72
2370  DRAW X1+I,LGT(Lsci(1,I))
2380  NEXT I
2390 Bypass: !
2400   LORG 1
2410   CSIZE 3
2420   MOVE X1-30,-9.5
2430   IF Plotter=0 THEN 2440
2440   ALPHA ON
2450   PRINT
2460   PRINT Info$
2470   PRINT "DATA FROM   ";File$[3,11]
2480  PRINT USING "35A,MD.DDDE";"AVERAGE PRESSURE IS    ",Ave_press
2490   PRINT USING "30A,40A,10A";"","ENG UNITS","DIT DATA"
2500   N1=Eng(1,1)-103
2510   N2=Eng(2,1)-103
2520   N3=Eng(3,1)-103
2530   N4=Eng(4,1)-103
2540   N5=Eng(1,1)
2550   PRINT USING 3220;"INTERLACE NUMBER ";N1,N2,N3,N4,N5
2560   N1=Eng(1,2)*20/255
2570   N2=Eng(2,2)*20/255
2580   N3=Eng(3,2)*20/255
2590   N4=Eng(4,2)*20/255
2600   N5=Eng(1,2)
2610   PRINT USING 3220;"+15 VOLTS ";N1,N2,N3,N4,N5
2620   N1=Eng(1,3)*(-30)/255
2630   N2=Eng(2,3)*(-30)/255
2640   N3=Eng(3,3)*(-30)/255
2650   N4=Eng(4,3)*(-30)/255
2660   N5=Eng(1,3)
2670   PRINT USING 3220;"-15 VOLTS ";N1,N2,N3,N4,N5
2680   N1=Eng(1,4)*5.E+3/255
2690   N2=Eng(2,4)*5.E+3/255
2700   N3=Eng(3,4)*5.E+3/255
2710   N4=Eng(4,4)*5.E+3/255
2720   N5=Eng(1,4)
2730   PRINT USING 3220;"ION PUMP VOLTAGE";N1,N2,N3,N4,N5
2740   N1=Eng(1,5)*2.5-110
2750   N2=Eng(2,5)*2.5-110
2760   N3=Eng(3,5)*2.5-110
2770   N4=Eng(4,5)*2.5-110
2780   N5=Eng(1,5)
2790   PRINT USING 3220;"ION SOURCE TEMP DEG F";N1,N2,N3,N4,N5
2800   N1=Eng(1,6)*1.105-93.136
2810   N2=Eng(2,6)*1.105-93.136
2820   N3=Eng(3,6)*1.105-93.136
2830   N4=Eng(4,6)*1.105-93.136
2840   N5=Eng(1,6)
2850   PRINT USING 3220;"PRE AMP TEMP DEG F";N1,N2,N3,N4,N5
2860   N1=Eng(1,7)*10/255
2870   N2=Eng(2,7)*10/255
2880   N3=Eng(3,7)*10/255
2890   N4=Eng(4,7)*10/255
2900   N5=Eng(1,7)
2910   PRINT USING 3220;"+5 VOLTS ";N1,N2,N3,N4,N5
2920   N1=Eng(1,8)*10/255
2930   N2=Eng(2,8)*10/255
```

```
2940    N3=Eng(3,8)*10/255
2950    N4=Eng(4,8)*10/255
2960    N5=Eng(1,8)
2970    PRINT USING 3220;"A/D REF VOLTAGE ";N1,N2,N3,N4,N5
2980    N1=Eng(1,9)*100/134
2990    N2=Eng(2,9)*100/134
3000    N3=Eng(3,9)*100/134
3010    N4=Eng(4,9)*100/134
3020    N5=Eng(1,9)
3030    PRINT USING 3220;"EMISSION CURR IN MICRO AMP";N1,N2,N3,N4,N5
3040    N1=Eng(1,10)*100/134
3050    N2=Eng(2,10)*100/134
3060    N3=Eng(3,10)*100/134
3070    N4=Eng(4,10)*100/134
3080    N5=Eng(1,10)
3090    PRINT USING 3220;"COLLECTOR CURR IN MICRO AMP";N1,N2,N3,N4,N5
3100    N1=Eng(1,11)*100/255
3110    N2=Eng(2,11)*100/255
3120    N3=Eng(3,11)*100/255
3130    N4=Eng(4,11)*100/255
3140    N5=Eng(1,11)
3150    PRINT USING 3220;"ELECTRON ACC VOLTAGE ";N1,N2,N3,N4,N5
3160    N1=Eng(1,12)*10/255
3170    N2=Eng(2,12)*10/255
3180    N3=Eng(3,12)*10/255
3190    N4=Eng(4,12)*10/255
3200    N5=Eng(1,12)
3210    PRINT USING 3220;"REF ION ACC VOLTAGE";N1,N2,N3,N4,N5
3220    IMAGE 30A,DDDD.DD,3X,DDDD.DD,3X,DDDD.DD,3X,DDDD.DD,6X,DDD
3230   Image$="DDD,2X,MD.DDE,4X,DDD,2X,MD.DDE,4X,DDD,2X,MD.DDE,4X,DDD,2X,MD.DDE"
3240   GOTO Off_prt_all
3250    Bkg=1.24E-13
3260    FOR I=1 TO 90
3270    PRINT USING Image$;I,Hsci(I,Sn)-Bkg,I+90,Hsci(90+I,Sn)-Bkg,I+180,Hsci(I+1
80,Sn)-Bkg,I+270,Hsci(I+270,Sn)-Bkg
3280    NEXT I
3290 Off_prt_all:  !
3300    GOSUB Peakpicker
3310    GOSUB Inststat
3320   RETURN
3330 Printout: !
3340    PRINTER IS 701
3350    PRINT TAB(15);"ENGINEERING DATA "
3360    FOR I=1 TO 12
3370    PRINT TAB(15);Eng(Sn,I)
3380    NEXT I
3390    PRINT
3400    PRINT TAB(15);"SCIENCE DATA "
3410    J=0
3420    FOR I=1 TO X1
3430    J=J+1
3440    IF J=INT(J/5)*5=J THEN 3480
3450    PRINT USING 3460;I,Hsci(Sn,I)
3460    IMAGE 3X,DDD,3X,MD.DDE
3470    GOTO 3500
3480    PRINT USING 3490;I,Hsci(Sn,I),Lsci(Sn,J/5)
3490    IMAGE  3X,DDD,3X,MD.DDDE,MD.DDDE
3500    NEXT I
3510    PRINT
3520    !
```

```
3530   PRINTER IS 1
3540   RETURN
3550 Peakpicker:  !
3560              PRINT
3570              DISP
3580  ALPHA ON
3590  GRAPHICS OFF
3591  CONTROL KBD,2;1
3600   DISP "WANT PEAK PICKER DATA ";
3610   Yesno(R5)
3620   ON R5 GOTO 3640,3630,3600
3630   RETURN
3640   PRINT "CURRENTS HAVE BASE VALUE OF -1.24E-13 REMOVED"
3641   CONTROL KBD,2;1
3650   Basi=1.24E-13
3660   PRINTER IS CRT
3670   PRINT USING "////"
3680   FOR I=1 TO 11
3690   PRINT "FOR MASS # ";Me(1,I);"  CURRENTS ARE"
3700   Peaks(I,1)=Me(1,I)
3710   MAT Curr= (0)*Curr
3720   Count=1
3730   FOR J=Me(2,I)-3 TO Me(2,I)+3
3740 ! GOTO 3860
3750   PRINT USING "DDD,5X,MD.DDE,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE";J,Hsci(1,J)-Bas
i,Hsci(2,J)-Basi,Hsci(3,J)-Basi,Hsci(4,J)-Basi
3760   Curr(Count)=Hsci(1,J)-Basi
3770   Count=Count+1
3780   Curr(Count)=Hsci(2,J)-Basi
3790   Count=Count+1
3800   Curr(Count)=Hsci(3,J)-Basi
3810   Count=Count+1
3820   Curr(Count)=Hsci(4,J)-Basi
3830   Count=Count+1
3840   NEXT J
3850   Overcurrent=0
3860   MAT SORT Curr(*)
3870   IF Curr(28)>6.5E-11 THEN Overcurrent=1
3880   IF Curr(27)>6.5E-11 THEN Overcurrent=2
3890   IF Curr(26)>6.5E-11 THEN Overcurrent=3
3900   IF Curr(25)>6.5E-11 THEN Overcurrent=4
3910   Ave_current=(Curr(36-Overcurrent)+Curr(35-Overcurrent)+Curr(34-Overcurren
t)+Curr(33-Overcurrent))/4
3920   PRINT USING "30A,MD.DDE";"     THE AVERAGE CURRENT IS   ";Ave_current
3930   PRINT
3940   DISP
3950   DISP "IS AVERAGE CURRENT OK  ?";
3960   Yesno(R5)
3970   ON R5 GOTO 4010,3980,3940
3980   DISP
3990   DISP "INPUT CORRECT AVE_CURRENT";
4000   INPUT Ave_current
4010   Peaks(I,2)=Ave_current
4020   DISP
4030   NEXT I
4040   PRINTER IS Printer
4050   FOR I=21 TO 67 STEP 23
4060   MAT Curr= (0)*Curr
4070   Count=1
4080   FOR J=-3 TO 3
```

```
4090    Curr(Count)=Lsci(1,I)
4100    Count=Count+1
4110    Curr(Count)=Lsci(2,I)
4120    Count=Count+1
4130    Curr(Count)=Lsci(3,I)
4140    Count=Count+1
4150    Curr(Count)=Lsci(4,I)
4160    Count=Count+1
4170    NEXT J
4180    MAT SORT Curr(*)
4190    Ave=(Curr(36)+Curr(35)+Curr(34)+Curr(33)+Curr(32)+Curr(31)+Curr(30)+Curr(
29))/8
4200    IF I=21 THEN Lpeaks(1)=Ave-6.2E-14
4210    IF I=44 THEN Lpeaks(2)=Ave-6.2E-14
4220    IF I=67 THEN Lpeaks(3)=Ave-6.2E-14
4230    NEXT I
4240    PRINT
4250    PRINT USING "25A,MD.DDE";"AVERAGE M/E 4  CURRENT",Lpeaks(1)
4260    PRINT USING "25A,MD.DDE";"AVERAGE M/E 2  CURRENT",Lpeaks(2)
4270    PRINT USING "25A,MD.DDE";"AVERAGE M/E 1  CURRENT",Lpeaks(3)
4280    PRINT
4290   PRINT "    MASS NUMBER              ION CURRENT"
4300   FOR I=1 TO 11
4310   PRINT USING "5X,DDD,20A,MD.DDE";Peaks(I,1),"   ---------------  ",Peaks(I,
2)
4320   NEXT I
4330   PRINT
4331   CONTROL KBD,2;0
4340    RETURN
4350 Disk_data:      !
4360                 Science=444
4370                 Disk_flag=1
4380                 L=LEN(File$)
4390                 File$=File$[3,L]
4400                 ASSIGN @Ab TO File$
4410                 ENTER @Ab;Info$
4420                 ENTER @Ab;Dat(*)
4430                 ENTER @Ab;Scan(*)
4440                 DISP
4450             !   DISP "ENTER PRESSURE DATA";
4460           !     Yesno(R5)
4470              !  ON R5 GOTO 4190,4220,4150
4480                 File$="P_"&File$
4490                 ASSIGN @Ab TO File$
4500                 ENTER @Ab;Press(*)
4510                 RETURN
4520 Inststat:!
4530              Sn=1
4540         FOR Fill_test=445 TO 448
4550         IF Scan(Sn,Fill_test)=0 THEN RETURN
4560         Stat_test=2^16+Scan(Sn,Fill_test)
4570           W47=INT(Stat_test/256)
4580           W48=Stat_test-W47*256
4590           PRINT USING "27A,DDDDD,3X,DDD,3X,DDD";"FOR SCAN # 1  STATUS WORD "
,Stat_test,W47,W48
4600           PRINT
4610           PRINT "     INSTRUMENT STATUS"
4620           Flag=BINAND(W48,1)
4630           ON Flag+1 GOSUB 5070,5090
4640           PRINT USING 5350;"INLET VALVE ",Status$
```

```
4650          Flag=BINAND(W48,2)/2
4660          ON Flag+1 GOSUB 5070,5090
4670          PRINT USING 5350;"RANGE VALVE ",Status$
4680          Flag=BINAND(W48,4)/4
4690          ON Flag+1 GOSUB 5070,5090
4700          PRINT USING 5350;"PROTECTION VALVE",Status$
4710          Flag=BINAND(W48,8)/8
4720          ON Flag+1 GOSUB 5310,5330
4730          PRINT USING 5350;"SYSTEM RESET",Status$
4740          Flag=BINAND(W48,16)/16
4750          ON Flag+1 GOSUB 5310,5330
4760          PRINT USING 5350;"UAMS RESET ",Status$
4770          Flag=BINAND(W48,32)/32
4780          ON Flag+1 GOSUB 5270,5250
4790          PRINT USING 5350;"DECODE ",Status$
4800          Flag=BINAND(W48,64)/64
4810          ON Flag+1 GOSUB 5290,5110
4820          PRINT USING 5350;"BUFFER OVERFLOW ",Status$
4830          Flag=BINAND(W48,128)/128
4840          ON Flag+1 GOSUB 5230,5110
4850          PRINT USING 5350;"PROCESSOR ",Status$
4860          PRINT
4870          Flag=BINAND(W47,1)
4880          ON Flag+1 GOSUB 5210,5110
4890          PRINT USING 5350;"PROGRAM ",Status$
4900          Flag=BINAND(W47,4)/4
4910          ON Flag+1 GOSUB 5170,5110
4920          PRINT USING 5350;"INTERNAL PRESSURE",Status$
4930          Flag=BINAND(W47,8)/8
4940          ON Flag+1 GOSUB 5190,5110
4950          PRINT USING 5350;"INLET PRESSURE",Status$
4960          Flag=BINAND(W47,16)/16
4970          ON Flag+1 GOSUB 5130,5150
4980          PRINT USING 5350;"INSTRUMENT POWER",Status$
4990          Flag=BINAND(W47,32)/32
5000          ON Flag+1 GOSUB 5130,5150
5010          PRINT USING 5350;"ION PUMP POWER",Status$
5020          Flag=BINAND(W47,64)/64
5030          ON Flag+1 GOSUB 5190,5110
5040          PRINT USING 5350;"ION PUMP CURRENT",Status$
5050          PRINT
5060          GOTO 5360
5070          Status$="OPEN"
5080          RETURN
5090          Status$="CLOSE"
5100          RETURN
5110          Status$="OK"
5120          RETURN
5130          Status$="ON"
5140          RETURN
5150          Status$="OFF"
5160          RETURN
5170          Status$="LOW"
5180          RETURN
5190          Status$="HIGH"
5200          RETURN
5210          Status$="ERROR"
5220          RETURN
5230          Status$="HALT"
5240          RETURN
```

```
5250           Status$="SEARCHING"
5260           RETURN
5270           Status$="ID FOUND"
5280           RETURN
5290           Status$="OVER FLOW"
5300           RETURN
5310           Status$="OPERATE RESET"
5320           RETURN
5330           Status$="RELEASE RESET"
5340           RETURN
5350           IMAGE 25A,15A
5360           NEXT Fill_test
5370           RETURN
5380 End:           !
5390                PRINT "END"
5400                DISP
5410                PEN 0
5420                PLOTTER IS 3,"INTERNAL"
5430                PRINTER IS CRT
5440                PEN 1
5450  END
5460   SUB Yesno(R5)
5470   LOOP
5480   ON KEY 1 LABEL "YES" GOTO 5570
5490   ON KEY 2 LABEL "" GOTO 5470
5500   ON KEY 3 LABEL "" GOTO 5470
5510   ON KEY 4 LABEL "NO" GOTO 5590
5520   ON KEY 5 LABEL "" GOTO 5470
5530   ON KEY 6 LABEL "" GOTO 5470
5540   ON KEY 7 LABEL "" GOTO 5470
5550   ON KEY 8 LABEL "REPEAT ?" GOTO 5610
5560   END LOOP
5570   R5=1
5580   GOTO Subend
5590   R5=2
5600   GOTO Subend
5610   R5=3
5620 Subend:  !
5630           SUBEND
5640     SUB Config36(Program$,Data$)
5650     DISP
5660     CONTROL KBD,2;1
5670     DISP "SELECT OPTION";
5680     LOOP
5690     ON KEY 0 LABEL "PROGRAM" GOTO 5670
5700     ON KEY 1 LABEL "INT,0" GOTO Pinternal0
5710     ON KEY 2 LABEL "INT,1" GOTO Pinternal1
5720     ON KEY 3 LABEL "700,0" GOTO P7000
5730     ON KEY 4 LABEL "700,1" GOTO P7001
5740     ON KEY 5 LABEL "DATA " GOTO 5680
5750     ON KEY 6 LABEL "INT,0" GOTO Dinternal0
5760     ON KEY 7 LABEL "INT,1" GOTO Dinternal1
5770     ON KEY 8 LABEL "700,0" GOTO D7000
5780     ON KEY 9 LABEL "700,1" GOTO D7001
5790     END LOOP
5800 Pinternal0:     !
5810                 Program$=":INTERNAL4,0"
5820                 GOTO Subend
5830 Pinternal1:              !
5840                Program$=":INTERNAL4,1"
```

```
5850                GOTO Subend
5860 P7000:        Program$=":,700,0"
5870      GOTO Subend
5880 P7001:         !
5890               Program$=":,700,1"
5900               GOTO Subend
5910 Dinternal0:    !
5920                Data$=":INTERNAL4,0"
5930                GOTO Subend
5940 Dinternal1: !
5950               Data$=":INTERNAL,4,1"
5960               GOTO Subend
5970 D7000:         Data$=":,700,0"
5980               GOTO Subend
5990 D7001:!
6000            Data$=":,700,1"
6010            GOTO Subend
6020 Subend: !
6030          BEEP
6040          Flag=Flag+1
6050          IF Flag=2 THEN 6100
6060          DISP
6080          DISP "SELECT NEXT OPTION";
6090          IF Flag<=1 THEN 5680
6100          PRINT "PROGRAM MSI IS ";Program$
6110          PRINT "DATA MSI IS ";Data$
6120          SUBEND
6130      SUB Config320(Program$,Data$)
6131      DISP
6132      DISP "SELECT OPTION";
6150      CONTROL KBD,2;1
6170      LOOP
6180      ON KEY 1 LABEL "PROGRAM" GOTO 6170
6190      ON KEY 2 LABEL "704,0" GOTO P7040
6201      ON KEY 3 LABEL "" GOTO 6170
6202      ON KEY 4 LABEL "704,1" GOTO P7041
6210      ON KEY 5 LABEL "700,0" GOTO P7000
6211      ON KEY 6 LABEL "" GOTO 6170
6212      ON KEY 7 LABEL "" GOTO 6170
6220      ON KEY 8 LABEL "700,1" GOTO P7001
6230      ON KEY 9 LABEL "DATA " GOTO 6170
6240      ON KEY 10 LABEL "704,0" GOTO D7040
6241      ON KEY 11 LABEL "" GOTO 6170
6250      ON KEY 12 LABEL "704,1" GOTO D7041
6260      ON KEY 13 LABEL "700,0" GOTO D7000
6261      ON KEY 14 LABEL "" GOTO 6170
6262      ON KEY 15 LABEL "" GOTO 6170
6270      ON KEY 16 LABEL "700,1" GOTO D7001
6280      END LOOP
6290 P7040:    !
6300                Program$=":,704,0"
6310                GOTO Subend
6320 P7041:                !
6330               Program$=":,704,1"
6340               GOTO Subend
6350 P7000:        Program$=":,700,0"
6360      GOTO Subend
6370 P7001:         !
6380               Program$=":,700,1"
6390               GOTO Subend
```

```
6400 D7040:    !
6410                Data$=":,704,0"
6420                GOTO Subend
6430 D7041: !
6440              Data$=":,704,1"
6450              GOTO Subend
6460 D7000:        Data$=":,700,0"
6470              GOTO Subend
6480 D7001:!
6490            Data$=":,700,1"
6500            GOTO Subend
6510 Subend: !
6520          BEEP
6530          Flag=Flag+1
6540          IF Flag=2 THEN 6590
6541          DISP
6542          DISP "SELECT NEXT OPTION";
6560          CONTROL KBD,2;2
6580          IF Flag<=1 THEN 6170
6590          PRINT "PROGRAM MSI IS ";Program$
6600          PRINT "DATA MSI IS ";Data$
6601          DISP
6605          CONTROL KBD,2;0
6606          DISP
6610          SUBEND
```

ATTACHMENT D - SUMS SOFTWARE LISTING

(3) DC_SUMS:

```
10 !    RE-STORE "DC_SUMS"
20 ! NOTE THIS VERSION USED WITH DATA FROM DYNAMIC CALIBRATION
30 ! IT ASSUMES N SCAN IN  ANY ORDER
40    !RJD   REVISION    11/10/88
50    OPTION BASE 1
60    GCLEAR
70    STATUS KBD,9;Keyb
80    IF (BIT(Keyb,5)=1) THEN CALL Config320(Program$,Data$)
90    IF (BIT(Keyb,5)=0) THEN CALL Config36(Program$,Data$)
100   MASS STORAGE IS Program$
110   DIM Cat$(1)[80],Image$[80],Info$[80]
120   DIM Lsci(72),Hsci(360),Me(11,2),Curr(36),Lut(16,32),Dat(21)
130   DIM Peaks(500,11),Lpeaks(500,3)
140   ASSIGN @Ab TO "LUT"
150   ENTER @Ab;Lut(*)
160   DISP
170   Printer=CRT
180   PRINTER IS Printer
190   PRINT CHR$(12)    ! FF CLEARS SCREEN
200   Mass_scale(Me(*))
210 ! CAT
220   PEN 0
230   PLOTTER IS 3,"INTERNAL"
240   PEN 1
250   ALPHA ON
260   GRAPHICS OFF
270   BEEP
280   WAIT 1
290   BEEP
300   MASS STORAGE IS Data$
310   DISP
320   DISP "INPUT FILE NAME";
330   INPUT File$
340   CAT TO Cat$(*);SELECT File$,NO HEADER
350   Nscans=INT(VAL(Cat$(1)[38,45])/3.5)
360   REDIM Peaks(Nscans,11),Lpeaks(Nscans,3)
370   ALLOCATE INTEGER Scan(Nscans,448),Eng(Nscans,12)
380   BEEP
390   DISP
400   DISP "PRINTER (P) OR SCREEN (S) ";
410   INPUT C$
420   IF C$[1,1]="S" OR C$[1,1]="s" THEN 480
430   IF C$[1,1]="P" OR C$[1,1]="p" THEN 460
440   BEEP
450   GOTO 390
460   Printer=701
470   PRINTER IS Printer
480   BEEP
490   DISP
500   C$=""
510   DISP "PLOTTER (P) OR SCREEN (S) ";
520   INPUT C$
530   IF C$[1,1]="S" OR C$[1,1]="s" THEN 660
540   IF C$[1,1]="P" OR C$[1,1]="p" THEN 570
550   BEEP
560   GOTO 490
570   BEEP
580   DISP
590   DISP "SELECT PEN";
600   INPUT Pen
```

```
610   PEN Pen
620   PLOTTER IS 705,"HPGL"
630   PRINTER IS 705
640   PRINT "VS10"
650   PRINTER IS Printer
660                 ASSIGN @Ab TO File$
670                 ENTER @Ab;Info$
680                 ENTER @Ab;Dat(*)
690                 ENTER @Ab;Scan(*)
700  MASS STORAGE IS Program$
710  DISP
720  DISP "WANT AUTO PEAK PICKER ";
730  Yesno(R5)
740  ON R5 GOTO 750,760,710
750  Auto=1
760 Scisep:          !
770                  FOR Scann=1 TO Nscans
780                  Engc=0
790                  FOR I=1 TO 12
800                  Eng_test=INT(Scan(Scann,I)/256)
810                  IF Eng_test<>4 THEN 840
820                  Engc=Engc+1
830                     Eng(Scann,I)=BINAND(Scan(Scann,I),255)
840                  NEXT I
850        W=Eng(Scann,1)-103  !*******************************************
860        IF W>0 AND W<5 THEN 920
870        BEEP
880        WAIT 1
890        PRINT "INTERLACE NUMBER DOES NOT CHECK"
900        BEEP
910    !   PAUSE
920        Highc=0
930        Lowc=W+13
940        Lown=0
950        FOR I=13 TO 444
960        Rr=0
970         IF I=Lowc THEN 1030
980         Highc=Highc+1
990         Sig=BINAND(Scan(Scann,I),31)
1000        Ran=BINAND(Scan(Scann,I),480)/32
1010        Hsci(Highc)=Lut(Ran+1,Sig+1)
1020        GOTO 1080
1030     Lown=Lown+1 !        LOW MASS HERE
1040        Sig=BINAND(Scan(Scann,I),31)
1050        Ran=BINAND(Scan(Scann,I),480)/32
1060        Lsci(Lown)=Lut(Ran+1,Sig+1)/2
1070     Lowc=Lowc+6
1080     NEXT I
1090   GOSUB Graphplot
1100   NEXT Scann
1110      GOTO End
1120  !"GRAPHPLOT"
1130 Graphplot: !*************************************************************
1140            GCLEAR
1150            ALPHA OFF
1160            GRAPHICS ON
1170 DEG
1180 !  Lmass=1    ! THIS SELECTS THE LOW MASS PLOT OPTION  REMOVE !
1190 X1=280                    !360   NOTE X1 USED IN STEP LABEL ETC
1200 X2=0
```

```
1210 X5=X1+72*(Lmass=1)  !IF SELECT LOW MASS PLOT X5=X1+72
1220 X3=X5+.1*ABS(X2-X5)
1230 X4=X2-.1*ABS(X2-X5)
1240 Y1=LGT(1.E-13)
1250 Y2=LGT(1.E-9)
1260 Y3=Y1-.1*ABS(Y2-Y1)
1270 Y4=Y2+.1*ABS(Y2-Y1)
1280 WINDOW X3,X4,Y3,Y4
1290 CLIP X5+(.05*ABS(X2-X5)),X2-(.05*ABS(X2-X5)),Y1-(.05*ABS(Y2-Y1)),Y2+(.05*AB
S(Y2-Y1))
1300! CLIP ON
1310  PENUP
1320  DIM A$[80],B$[80]
1330  A$="STEP NUMBER"
1340  B$="ION CURRENT IN AMPERE"
1350  MOVE X5,Y1
1360  DRAW X5,Y2
1370  DRAW X2,Y2
1380  DRAW X2,Y1
1390  DRAW X5,Y1
1400  J=1
1410  FOR X=X5 TO X2 STEP X2-X5
1420  FOR Y=Y1 TO Y2-1 STEP 1
1430! MOVE X,Y   ! DRAW DECADE LINES
1440! DRAW X2,Y  !DRAWS DECADE LINES
1450  FOR I=1 TO 10 STEP 1
1460  MOVE X,Y+LGT(I)
1470  IPLOT .01*J*(X2-X5),0,1
1480  IPLOT -.01*J*(X2-X5),0,1
1490  IF I<10 THEN 1520
1500  IPLOT J*.04*(X2-X5),0,1
1510  IPLOT J*(-.04)*(X2-X5),0,1
1520  NEXT I
1530  NEXT Y
1540  PENUP
1550  J=-1
1560  NEXT X
1570  FOR I=Y1 TO Y2 STEP 1
1580  MOVE X5-.045*(X2-X5),I-.015*(Y2-Y1)
1590  CLIP OFF
1600  LORG 6
1610  CSIZE 2.5,.6
1620  LABEL "10"
1630  MOVE X5-.016*(X2-X5),I
1640  LORG 5
1650  LABEL INT(I)
1660  CLIP ON
1670  NEXT I
1680  CLIP OFF
1690 MOVE X5-(X2-X5)*.100,(Y2+Y1)/2
1700 LDIR 90                              !DIRECTION OF YAXIS  NAME
1710 CSIZE 4,.6                           !SIZE OF YAXIS MAME
1720 LORG 6                               !CENTERS AND LOCATES YAXIS NAME
1730  LABEL (B$)
1740  LORG 1                              !NORMAL VALUE FOR LORG
1750  PENUP
1760  LDIR 0                              !NORMAL VALUE FOR LDIR
1770! GOTO 630  ! BY PASS LABEL STEP
1780  FOR I=0 TO X1 STEP 10
1790  MOVE I,-9
```

```
1800  IPLOT 0,-.05
1810  IPLOT 0,+.05
1820  NEXT I
1830  CSIZE 3
1840  LORG 5
1850  FOR I=50 TO X1 STEP 50
1860  MOVE I,-9.00
1870  IPLOT 0,-.10
1880  IPLOT 0,+.10
1890  MOVE I,-8.85
1900  LABEL I
1910  NEXT I
1920  MOVE (X2+X1)/2,Y2+.105*(Y2-Y1)
1930  CSIZE 3,.6                              !SIZE OF XAXIS NAME
1940  LORG 6                                  !CENTERS AND LOCATES XAXIS NAME
1950  LABEL Info$[1,25]&"        "&Info$[50,80]
1960  LORG 3
1970  MOVE 250,-9.2
1980  LABEL USING "15A,22A,8A,DDDD";"DATA FROM  ",File$,"SCAN  #  ",Scann
1990 LORG 5
2000 CSIZE 3
2010  FOR I=1 TO 11
2020 MOVE Me(I,2),Y1
2030  IPLOT 0,+.05
2040  IPLOT 0,-.05
2050  MOVE Me(I,2),-13.1
2060  LABEL Me(I,1)
2070  NEXT I
2080  CSIZE 5
2090  LORG 4
2100  MOVE (X1-X2)/2,Y1-.4
2110  LABEL "MASS NUMBER"
2120  MOVE 0,-12.9   !LGT(1.24E-13)
2130  FOR I=1 TO X1
2140  DRAW I,LGT(Hsci(I))
2150  NEXT I
2160! DUMP GRAPHICS #701
2170  IF Lmass=0 THEN GOTO Bypass    !BY PASS LOW MASS PLOT
2180 Lowmass:  !
2190  MOVE X1,-13.2   !LGT(6.2E-14)
2200  FOR I=1 TO 72
2210  DRAW X1+I,LGT(Lsci(I))
2220  NEXT I
2230 Bypass: !
2240   LORG 1
2250   CSIZE 3
2260   MOVE X1-30,-9.5
2270   IF Plotter=0 THEN 2280
2280   ALPHA ON
2290   PRINT
2300   PRINT Info$
2310   PRINT "DATA FROM   ";File$
2320   PRINT "  FOR SCAN #    ";Scann
2330   PRINT USING "30A,15A,10A";"","ENG UNITS","DIT DATA"
2340   N1=Eng(Scann,1)-103
2350   N5=Eng(Scann,1)
2360   PRINT USING 2700;"INTERLACE NUMBER ";N1,N5
2370   N1=Eng(Scann,2)*20/255
2380   N5=Eng(Scann,2)
2390   PRINT USING 2700;"+15 VOLTS ";N1,N5
```

```
2400   N1=Eng(Scann,3)*(-30)/255
2410   N5=Eng(Scann,3)
2420   PRINT USING 2700;"-15 VOLTS ";N1,N5
2430   N1=Eng(Scann,4)*5.E+3/255
2440   N5=Eng(Scann,4)
2450   PRINT USING 2700;"ION PUMP VOLTAGE";N1,N5
2460   N1=Eng(Scann,5)*2.5-110
2470   N5=Eng(Scann,5)
2480   PRINT USING 2700;"ION SOURCE TEMP DEG F";N1,N5
2490   N1=Eng(Scann,6)*1.105-93.136
2500   N5=Eng(Scann,6)
2510   PRINT USING 2700;"PRE AMP TEMP DEG F";N1,N5
2520   N1=Eng(Scann,7)*10/255
2530   N5=Eng(Scann,7)
2540   PRINT USING 2700;"+5 VOLTS ";N1,N5
2550   N1=Eng(Scann,8)*10/255
2560   N5=Eng(Scann,8)
2570   PRINT USING 2700;"A/D REF VOLTAGE ";N1,N5
2580   N1=Eng(Scann,9)*100/134
2590   N5=Eng(Scann,9)
2600   PRINT USING 2700;"EMISSION CURR IN MICRO AMP";N1,N5
2610   N1=Eng(Scann,10)*100/134
2620   N5=Eng(Scann,10)
2630   PRINT USING 2700;"COLLECTOR CURR IN MICRO AMP";N1,N5
2640   N1=Eng(Scann,11)*100/255
2650   N5=Eng(Scann,11)
2660   PRINT USING 2700;"ELECTRON ACC VOLTAGE ";N1,N5
2670   N1=Eng(Scann,12)*10/255
2680   N5=Eng(Scann,12)
2690   PRINT USING 2700;"REF ION ACC VOLTAGE";N1,N5
2700   IMAGE 30A,DDDD.DD,10X,DDD
2710  Image$="DDD,2X,MD.DDE,4X,DDD,2X,MD.DDE,4X,DDD,2X,MD.DDE,4X,DDD,2X,MD.DDE"
2720  GOTO Off_prt_all
2730   Bkg=1.24E-13
2740   FOR I=1 TO 90
2750   PRINT USING Image$;I,Hsci(I)-Bkg,I+90,Hsci(90+I)-Bkg,I+180,Hsci(I+180)-Bk
g,I+270,Hsci(I+270)-Bkg
2760   NEXT I
2770 Off_prt_all:  !
2780                              !  IF Auto = 1 THEN AUTOMATIC PEAK PICKER
2790   GOSUB Peakpicker
2800   GOSUB Inststat
2810  RETURN
2820 Printout: !
2830   PRINTER IS 701
2840   PRINT TAB(15);"ENGINEERING DATA "
2850   FOR I=1 TO 12
2860   PRINT TAB(15);Eng(Scann,I)
2870   NEXT I
2880   PRINT
2890   PRINT TAB(15);"SCIENCE DATA "
2900   J=0
2910   FOR I=1 TO X1
2920   J=J+1
2930   IF J=INT(J/5)*5=J THEN 2970
2940   PRINT USING 2950;I,Hsci(I)
2950   IMAGE 3X,DDD,3X,MD.DDE
2960   GOTO 2990
2970   PRINT USING 2980;I,Hsci(I),Lsci(J/5)
2980   IMAGE  3X,DDD,3X,MD.DDDE,MD.DDDE
```

```
2990    NEXT I
3000    PRINT
3010    !
3020    PRINTER IS 1
3030    RETURN
3040 Peakpicker:  !
3050              IF Auto=1 THEN 3140
3060              PRINT
3070              DISP
3080  ALPHA ON
3090  GRAPHICS OFF
3100   DISP "WANT PEAK PICKER DATA ";
3110   Yesno(R5)
3120   ON R5 GOTO 3140,3130,3100
3130   RETURN
3140   PRINTER IS CRT
3150   Basi=1.24E-13
3160   FOR I=1 TO 11
3170   IF Auto=1 THEN 3230
3180   PRINT CHR$(12)      ! CLEARS SCREEN
3190   PRINT USING "/////"
3200   PRINT "CURRENTS HAVE BASE VALUE OF -1.24E-13 REMOVED"
3210   PRINT
3220   PRINT "FOR MASS # ";Me(I,1);"  CURRENTS ARE"
3230   MAT Curr= (0)*Curr
3240   Count=1
3250   FOR J=Me(I,2)-4 TO Me(I,2)+4
3260   IF Auto=1 THEN 3280
3270   PRINT USING "DDD,5X,MD.DDE";J,Hsci(J)-Basi
3280   Curr(Count)=Hsci(J)-Basi
3290   Count=Count+1
3300   NEXT J
3310   Overcurrent=0
3320   MAT SORT Curr(*)
3330   IF Curr(36)>6.5E-11 THEN Overcurrent=1
3340   Ave_current=(Curr(36-Overcurrent)+Curr(35-Overcurrent))/2
3350   IF Auto=1 THEN 3450
3360   PRINT
3370   PRINT USING "30A,MD.DDE";"     THE AVERAGE CURRENT IS   ";Ave_current
3380   DISP
3390   DISP "IS AVERAGE CURRENT OK  ?";
3400   Yesno(R5)
3410   ON R5 GOTO 3450,3420,3380
3420   DISP
3430   DISP "INPUT CORRECT AVE_CURRENT";
3440   INPUT Ave_current
3450   Peaks(Scann,I)=Ave_current
3460   DISP
3470   NEXT I
3480   PRINTER IS Printer
3490   FOR I=21 TO 67 STEP 23
3500   MAT Curr= (0)*Curr
3510   Count=1
3520   FOR J=-3 TO 3
3530   Curr(Count)=Lsci(I+J)
3540   Count=Count+1
3550   NEXT J
3560   MAT SORT Curr(*)
3570   Ave=(Curr(36)+Curr(35))/2
3580   IF I=21 THEN Lpeaks(Scann,1)=Ave-6.2E-14
```

```
3590   IF I=44 THEN Lpeaks(Scann,2)=Ave-6.2E-14
3600   IF I=67 THEN Lpeaks(Scann,3)=Ave-6.2E-14
3610   NEXT I
3620   PRINT
3630  PRINT "    MASS NUMBER              ION CURRENT"
3640   PRINT USING "25A,MD.DDE";"AVERAGE M/E 4  CURRENT",Lpeaks(Scann,1)
3650   PRINT USING "25A,MD.DDE";"AVERAGE M/E 2  CURRENT",Lpeaks(Scann,2)
3660   PRINT USING "25A,MD.DDE";"AVERAGE M/E 1  CURRENT",Lpeaks(Scann,3)
3670   PRINT
3680  PRINT "    MASS NUMBER              ION CURRENT"
3690  FOR I=1 TO 11
3700  PRINT USING "5X,DDD,20A,MD.DDE";Me(I,1),"   ---------------  ",Peaks(Scann
,I)
3710  NEXT I
3720  PRINT
3730   RETURN
3740 Inststat:!
3750    !
3760        FOR Fill_test=445 TO 448
3770        IF Scan(Scann,Fill_test)=0 THEN RETURN
3780        Stat_test=2^16+Scan(Scann,Fill_test)
3790          W47=INT(Stat_test/256)
3800          W48=Stat_test-W47*256
3810          PRINT USING "27A,DDDDD,3X,DDD,3X,DDD";"FOR SCAN # 1  STATUS WORD "
,Stat_test,W47,W48
3820          PRINT
3830          PRINT "FOR SCAN #     ";Scann
3840          PRINT "     INSTRUMENT STATUS"
3850          Flag=BINAND(W48,1)
3860          ON Flag+1 GOSUB 4300,4320
3870          PRINT USING 4580;"INLET VALVE ",Status$
3880          Flag=BINAND(W48,2)/2
3890          ON Flag+1 GOSUB 4300,4320
3900          PRINT USING 4580;"RANGE VALVE ",Status$
3910          Flag=BINAND(W48,4)/4
3920          ON Flag+1 GOSUB 4300,4320
3930          PRINT USING 4580;"PROTECTION VALVE",Status$
3940          Flag=BINAND(W48,8)/8
3950          ON Flag+1 GOSUB 4540,4560
3960          PRINT USING 4580;"SYSTEM RESET",Status$
3970          Flag=BINAND(W48,16)/16
3980          ON Flag+1 GOSUB 4540,4560
3990          PRINT USING 4580;"UAMS RESET ",Status$
4000          Flag=BINAND(W48,32)/32
4010          ON Flag+1 GOSUB 4500,4480
4020          PRINT USING 4580;"DECODE ",Status$
4030          Flag=BINAND(W48,64)/64
4040          ON Flag+1 GOSUB 4520,4340
4050          PRINT USING 4580;"BUFFER OVERFLOW ",Status$
4060          Flag=BINAND(W48,128)/128
4070          ON Flag+1 GOSUB 4460,4340
4080          PRINT USING 4580;"PROCESSOR ",Status$
4090          PRINT
4100          Flag=BINAND(W47,1)
4110          ON Flag+1 GOSUB 4440,4340
4120          PRINT USING 4580;"PROGRAM ",Status$
4130          Flag=BINAND(W47,4)/4
4140          ON Flag+1 GOSUB 4400,4340
4150          PRINT USING 4580;"INTERNAL PRESSURE",Status$
4160          Flag=BINAND(W47,8)/8
```

```
4170            ON Flag+1 GOSUB 4420,4340
4180            PRINT USING 4580;"INLET PRESSURE",Status$
4190            Flag=BINAND(W47,16)/16
4200            ON Flag+1 GOSUB 4360,4380
4210            PRINT USING 4580;"INSTRUMENT POWER",Status$
4220            Flag=BINAND(W47,32)/32
4230            ON Flag+1 GOSUB 4360,4380
4240            PRINT USING 4580;"ION PUMP POWER",Status$
4250            Flag=BINAND(W47,64)/64
4260            ON Flag+1 GOSUB 4420,4340
4270            PRINT USING 4580;"ION PUMP CURRENT",Status$
4280            PRINT
4290            GOTO 4590
4300            Status$="OPEN"
4310            RETURN
4320            Status$="CLOSE"
4330            RETURN
4340            Status$="OK"
4350            RETURN
4360            Status$="ON"
4370            RETURN
4380            Status$="OFF"
4390            RETURN
4400            Status$="LOW"
4410            RETURN
4420            Status$="HIGH"
4430            RETURN
4440            Status$="ERROR"
4450            RETURN
4460            Status$="HALT"
4470            RETURN
4480            Status$="SEARCHING"
4490            RETURN
4500            Status$="ID FOUND"
4510            RETURN
4520            Status$="OVER FLOW"
4530            RETURN
4540            Status$="OPERATE RESET"
4550            RETURN
4560            Status$="RELEASE RESET"
4570            RETURN
4580            IMAGE 25A,15A
4590            NEXT Fill_test
4600            RETURN
4610 End:           !
4620                PRINT "END"
4630                DISP
4640                PEN 0
4650                PLOTTER IS 3,"INTERNAL"
4660                PRINTER IS CRT
4670                PEN 1
4680                BEEP
4690                DISP
4700                DISP "WANT TO STORE THE DATA FROM PEAKS ";
4710                Yesno(R5)
4720                ON R5 GOTO 4730,4850,4690
4730                DISP
4740                MASS STORAGE IS Data$
4750                DISP "INPUT FILE NAME FOR PEAKS DATA FILE";
4760                INPUT Dat$
```

```
4770              L=LEN(Dat$)
4780              IF L>10 THEN 4730
4790              CREATE BDAT Dat$,Nscans,88
4800              ASSIGN @Ab TO Dat$
4810              OUTPUT @Ab;Peaks(*)
4820              PRINT "DATA STORED ON DATA FILE  ";Dat$
4830              BEEP
4840              MASS STORAGE IS Program$
4850  END
4860   SUB Yesno(R5)
4870   LOOP
4880   ON KEY 1 LABEL "YES" GOTO 4970
4890   ON KEY 2 LABEL "" GOTO 4870
4900   ON KEY 3 LABEL "" GOTO 4870
4910   ON KEY 4 LABEL "NO" GOTO 4990
4920   ON KEY 5 LABEL "" GOTO 4870
4930   ON KEY 6 LABEL "" GOTO 4870
4940   ON KEY 7 LABEL "" GOTO 4870
4950   ON KEY 8 LABEL "REPEAT ?" GOTO 5010
4960   END LOOP
4970   R5=1
4980   GOTO Subend
4990   R5=2
5000   GOTO Subend
5010   R5=3
5020 Subend:  !
5030          SUBEND
5040     SUB Config36(Program$,Data$)
5050     DISP
5060     CONTROL KBD,2;1
5070     DISP "SELECT OPTION";
5080     LOOP
5090     ON KEY 0 LABEL "PROGRAM" GOTO 5070
5100     ON KEY 1 LABEL "INT,0" GOTO Pinternal0
5110     ON KEY 2 LABEL "INT,1" GOTO Pinternal1
5120     ON KEY 3 LABEL "700,0" GOTO P7000
5130     ON KEY 4 LABEL "700,1" GOTO P7001
5140     ON KEY 5 LABEL "DATA " GOTO 5080
5150     ON KEY 6 LABEL "INT,0" GOTO Dinternal0
5160     ON KEY 7 LABEL "INT,1" GOTO Dinternal1
5170     ON KEY 8 LABEL "700,0" GOTO D7000
5180     ON KEY 9 LABEL "700,1" GOTO D7001
5190     END LOOP
5200 Pinternal0:    !
5210                Program$=":INTERNAL4,0"
5220                GOTO Subend
5230 Pinternal1:                !
5240               Program$=":INTERNAL4,1"
5250               GOTO Subend
5260 P7000:       Program$=":,700,0"
5270      GOTO Subend
5280 P7001:       !
5290             Program$=":,700,1"
5300             GOTO Subend
5310 Dinternal0:   !
5320               Data$=":INTERNAL4,0"
5330               GOTO Subend
5340 Dinternal1: !
5350             Data$=":INTERNAL,4,1"
5360             GOTO Subend
```

```
5370 D7000:        Data$=":,700,0"
5380              GOTO Subend
5390 D7001:!
5400             Data$=":,700,1"
5410             GOTO Subend
5420 Subend: !
5430           BEEP
5440           Flag=Flag+1
5450           IF Flag=2 THEN 5490
5460           DISP
5470           DISP "SELECT NEXT OPTION";
5480           IF Flag<=1 THEN 5080
5490           PRINT "PROGRAM MSI IS ";Program$
5500           PRINT "DATA MSI IS ";Data$
5510           SUBEND
5520       SUB Config320(Program$,Data$)
5530       DISP
5540       DISP "SELECT OPTION";
5550       CONTROL KBD,2;1
5560       LOOP
5570       ON KEY 1 LABEL "PROGRAM" GOTO 5560
5580       ON KEY 2 LABEL "704,0" GOTO P7040
5590       ON KEY 3 LABEL "" GOTO 5560
5600       ON KEY 4 LABEL "704,1" GOTO P7041
5610       ON KEY 5 LABEL "700,0" GOTO P7000
5620       ON KEY 6 LABEL "" GOTO 5560
5630       ON KEY 7 LABEL "" GOTO 5560
5640       ON KEY 8 LABEL "700,1" GOTO P7001
5650       ON KEY 9 LABEL "DATA " GOTO 5560
5660       ON KEY 10 LABEL "704,0" GOTO D7040
5670       ON KEY 11 LABEL "" GOTO 5560
5680       ON KEY 12 LABEL "704,1" GOTO D7041
5690       ON KEY 13 LABEL "700,0" GOTO D7000
5700       ON KEY 14 LABEL "" GOTO 5560
5710       ON KEY 15 LABEL "" GOTO 5560
5720       ON KEY 16 LABEL "700,1" GOTO D7001
5730       END LOOP
5740 P7040:     !
5750                Program$=":,704,0"
5760                GOTO Subend
5770 P7041:                !
5780               Program$=":,704,1"
5790               GOTO Subend
5800 P7000:       Program$=":,700,0"
5810       GOTO Subend
5820 P7001:       !
5830              Program$=":,700,1"
5840              GOTO Subend
5850 D7040:    !
5860                Data$=":,704,0"
5870                GOTO Subend
5880 D7041: !
5890              Data$=":,704,1"
5900              GOTO Subend
5910 D7000:        Data$=":,700,0"
5920              GOTO Subend
5930 D7001:!
5940            Data$=":,700,1"
5950            GOTO Subend
5960 Subend: !
```

```
5970          BEEP
5980          Flag=Flag+1
5990          IF Flag=2 THEN 6040
6000          DISP
6010          DISP "SELECT NEXT OPTION";
6020          CONTROL KBD,2;2
6030          IF Flag<=1 THEN 5560
6040          PRINT "PROGRAM MSI IS ";Program$
6050          PRINT "DATA MSI IS ";Data$
6060          DISP
6070          CONTROL KBD,2;0
6080          DISP
6090          SUBEND
6100          SUB Mass_scale(Me(*))
6110  ! "STEP_AMU"
6120  ! CAL OF STEP LOCATIONS FROM TWO KNOWN STEPS AND AMU
6130 Step1=27
6140 Amu1=44
6150 Step2=251
6160 Amu2=12
6170  A=(LGT(Amu2)-LGT(Amu1))/(Step2-Step1)
6180  B=LGT(Amu1)-A*Step1
6190  FOR I=1 TO 11
6200  READ Amu
6210  DATA 44,40,32,30,28,22,20,18,16,14,12
6220  Step=INT((LGT(Amu)-B)/A+.5)
6230  Me(I,1)=Amu
6240  Me(I,2)=Step
6250  NEXT I
6260          SUBEND
```

ATTACHMENT D - SUMS SOFTWARE LISTING

(4) SUMS90:

```
10 !     RE-STORE "SUMS90"
20*
30     ! REVISION 5/15/90   RJD
40     OPTION BASE 1
50     DIM Ps(50,2)
60     !READ DATA FROM HARD DISK FILE
70     INTEGER Mass_scale(12480)
80     INTEGER Screen(12480)
90     DIM Hi$[512]
100    INTEGER Row,Column,Index,Aa,Bb,Maxstep
110    Maxstep=280
120    DIM Sums(380),Pea(7)
130    Config36(Program$,Data$)
140 ! Config320(Program$,Data$)
150    MASS STORAGE IS Data$
160    CAT
170    DISP "INPUT FILE NAME";
180    INPUT Dfile$
190    ASSIGN @Ab TO Dfile$
200    ENTER @Ab;Sums(*)
210    Num_scan=Sums(4)
220    ALLOCATE Peaks(Num_scan,12)
230    ASSIGN @Ab TO Dfile$
240    FOR Sk=1 TO 0              !NUMBER OF SCANS TO SKIP
250    ENTER @Ab;Sums(*)
260    NEXT Sk
270    GOSUB Graphplot
280    Dumpcount=0
290 ! Page
300  ! OUTPUT 701 USING "/"
310    Clear
320    FOR Jj=1 TO Num_scan
330    ENTER @Ab;Sums(*)
340!   GOSUB Printout
350    IF Sums(5)<0 THEN 540
360    Peaks(Jj,12)=Sums(8)*3.6E+3+Sums(9)*60+Sums(10)+Sums(11)/1000
370    GLOAD Mass_scale(*)
380    GOSUB Englabel
390    MOVE 0,LGT(1.E-13)
400    FOR I=14 TO Maxstep+13
410    IF Sums(I)=0 THEN Sums(I)=1.E-14
420    DRAW I-13,LGT(Sums(I))
430    NEXT I
440 ! DUMP GRAPHICS #701
450 ! Dumpscreen
460 ! OUTPUT 701 USING "/"
470    Dumpcount=Dumpcount+1
480    IF Dumpcount=2 THEN 500
490    IF Dumpcount<2 THEN 530
500!   Page
510   !OUTPUT 701 USING "/"
520    Dumpcount=0
530    GOSUB Peakpicker
540    NEXT Jj
550 ! GOSUB Peakstore
560    PRINTER IS 701
570    FOR I=1 TO Num_scan
580 ! PRINT USING 247;I,Peaks(I,1),Peaks(I,2),Peaks(I,3),Peaks(I,4),Peaks(I,5),P
eaks(I,10),Peaks(I,11)
590    !
```

SUMS 1

```
600   !
610   IMAGE DD, 7(1X,MD.DDE)
620   NEXT I
630   PRINTER IS 1
640   GOSUB Peakplot
650   PAUSE
660 Graphplot:  !************************************************************
670   ! "GRAPHPLOT"
680   IF Cc<>0 THEN 690
690   PEN 1
700   PLOTTER IS 3,"INTERNAL"
710   GINIT
720   ALPHA ON
730   GRAPHICS OFF
740 ! DISP "PLOTTER OR SCREEN";
750         C$="S"
760   IF C$="S" OR C$="s" THEN 810
770   DISP "SELECT PEN";
780   INPUT Pen
790   PEN Pen
800   PLOTTER IS 705,"HPGL"
810 !
820             GCLEAR
830             ALPHA OFF
840             GRAPHICS ON
850  DEG
860  X1=Maxstep              !360
870  X2=0
880  X3=X1+.1*ABS(X2-X1)
890  X4=X2-.2*ABS(X2-X1)
900  Y1=LGT(1.E-13)
910  Y2=LGT(1.E-9)
920  Y3=Y1-.1*ABS(Y2-Y1)
930  Y4=Y2+.1*ABS(Y2-Y1)
940  WINDOW X3,X4,Y3,Y4
950! FRAME
960 !MOVE X3,Y1+.01*Y1
970! DRAW X3,Y3
980! DRAW X1+.06*X1,Y3
990 !MOVE X2-.06*X1,Y4
1000!DRAW X4,Y4
1010! DRAW X4,Y2-.01*Y1
1020 CLIP X1+(.05*ABS(X2-X2)),X2-(.05*ABS(X2-X1)),Y1-(.05*ABS(Y2-Y1)),Y2+(.05*AB
S(Y2-Y1))
1030! CLIP ON
1040  PENUP
1050  DIM A$[80],B$[80]
1060  A$="STEP NUMBER"
1070  B$="ION CURRENT IN AMPERE"
1080  MOVE X1,Y1
1090  DRAW X1,Y2
1100  DRAW X2,Y2
1110  DRAW X2,Y1
1120  DRAW X1,Y1
1130  J=1
1140  FOR X=X1 TO X2 STEP X2-X1
1150  FOR Y=Y1 TO Y2-1 STEP 1
1160! MOVE X,Y   ! DRAW DECADE LINES
1170! DRAW X2,Y  !DRAWS DECADE LINES
1180  FOR I=1 TO 10 STEP 1
```

Page 2

```
1190  MOVE X,Y+LGT(I)
1200  IPLOT .01*J*(X2-X1),0,1
1210  IPLOT -.01*J*(X2-X1),0,1
1220  IF I<10 THEN 1250
1230  IPLOT J*.04*(X2-X1),0,1
1240  IPLOT J*(-.04)*(X2-X1),0,1
1250  NEXT I
1260  NEXT Y
1270  PENUP
1280  J=-1
1290  NEXT X
1300  FOR I=Y1 TO Y2 STEP 1
1310  MOVE X1-.045*(X2-X1),I-.015*(Y2-Y1)
1320  CLIP OFF
1330  LORG 6
1340  CSIZE 2.5,.6
1350  LABEL "10"
1360  MOVE X1-.016*(X2-X1),I
1370  LORG 5
1380  LABEL INT(I)
1390  CLIP ON
1400  NEXT I
1410  CLIP OFF
1420 MOVE X1-(X2-X1)*.100,(Y2+Y1)/2
1430 LDIR 90                                  !DIRECTION OF YAXIS  NAME
1440 CSIZE 4,.6                               !SIZE OF YAXIS MAME
1450 LORG 6                                   !CENTERS AND LOCATES YAXIS NAME
1460  LABEL (B$)
1470  LORG 1                                  !NORMAL VALUE FOR LORG
1480  PENUP
1490  LDIR 0                                  !NORMAL VALUE FOR LDIR
1500! GOTO 630  ! BY PASS LABEL STEP
1510  FOR I=0 TO X1 STEP 10
1520  MOVE I,-9
1530  IPLOT 0,-.05
1540  IPLOT 0,+.05
1550  NEXT I
1560  CSIZE 3
1570  LORG 5
1580  FOR I=50 TO X1 STEP 50
1590  MOVE I,-9.00
1600  IPLOT 0,-.10
1610  IPLOT 0,+.10
1620  MOVE I,-8.85
1630  LABEL I
1640  NEXT I
1650  MOVE (X2+X1)/2,Y2+.100*(Y2-Y1)
1660  CSIZE 4.5,.6                              !SIZE OF XAXIS NAME
1670  LORG 6                                   !CENTERS AND LOCATES XAXIS NAME
1680  LABEL A$
1690  !
1700  ! "STEP_AMU"
1710  ! CAL OF STEP LOCATIONS FROM TWO KNOWN STEPS AND AMU
1720 !DISP "INPUT STEP,1 AMU 1";
1730 !INPUT Step1,Amu1
1740 ! Step1=100.5   !UTD INTEGRATION TEST
1750 Step1=26.5    !IVT INTEGRATION TEST
1760 Amu1=44
1770 !DISP "INPUT STEP 2,AMU 2";
1780 !INPUT Step2,Amu2
```

```
1790  ! Step2=221  ! UTD INTEGRATION TEST
1800 Step2=224  ! IVT INTEGRATION TEST
1810 Amu2=14
1820  A=(LOG(Amu2)-LOG(Amu1))/(Step2-Step1)
1830  B=LOG(Amu1)-A*Step1
1840 !PRINT "LGT(AMU)= SLOPE *STEP+CONSTANT"
1850 !PRINT "SLOPE = ";A;"    CONSTANT = ";B
1860 !PRINT
1870 !PRINT "AMU","STEP","STEP RANGE"
1880 LORG 5
1890 CSIZE 3
1900  FOR I=1 TO 50
1910! READ Amu
1920 !DATA 44,40,32,30,28,22,20,18,16,14,12
1930  Step=INT((LOG(I)-B)/A+.5)
1940  Ps(I,1)=I
1950  Ps(I,2)=Step
1960  NEXT I
1970  FOR I=12 TO 50 STEP 2
1980 !PRINT Amu,Step,Step-2;"-";Step+2
1990 IF I=24 OR I=26 OR I=34 OR I=38 OR I=42 OR I=46 OR I=48 THEN 2050
2000 MOVE Ps(I,2),-13
2010  IPLOT 0,+.07
2020  IPLOT 0,-.07
2030  MOVE Ps(I,2),-13.1
2040  LABEL Ps(I,1)
2050  NEXT I
2060  RESTORE
2070  FOR I=11 TO 50
2080  Step=INT((LOG(I)-B)/A+.5)
2090 MOVE Step,-13
2100  IPLOT 0,+.025
2110  IPLOT 0,-.025
2120  MOVE Step,-13.1
2130  NEXT I
2140  CSIZE 5
2150  LORG 4
2160  MOVE (X1-X2)/2,-13.4
2170  LABEL "MASS NUMBER"
2180  GSTORE Mass_scale(*)
2190  RETURN
2200 Printout:  !*************************************************************
2210            PRINTER IS 701
2220            J=1
2230            FOR I=1 TO 76
2240            PRINT USING 2250;J,Sums(J),Sums(J+1),Sums(J+2),Sums(J+3),Sums(J+
4)
2250            IMAGE DDD,3X,MD.DDDE,3X,MD.DDDE,3X,MD.DDDE,3X,MD.DDDE,3X,MD.DDDE
2260            J=J+5
2270            NEXT I
2280            PRINTER IS 1
2290            PAUSE
2300            RETURN
2310 Peakpicker:!  ***********************************************************
2320           ! STD PICK PICKER   11 PEAKS
2330           ! PEAKS LOCATION ARE DETERMINED IN GRAPH PLOT
2340           !MATRIX PS(I,1)AMU ,PS(I,2) = STEP)
2350           ! SCIENCE DATA IN SUMS(380) STARTING AT LOCATION 14;STEP 1
2360           ! ALLOCATE PEAKS(NUMBER OF SCANS,11) IN MAIN PROGRAM
2370           DIM Rp(11)
```

```
2380            DATA 44,40,32,30,28,22,20,18,16,14,12
2390            READ Rp(*)
2400            RESTORE 2380
2410            FOR Peak=1 TO 11
2420            Cc=1
2430         !  Amu=Me(Peak,1)
2440            PRINT "FOR MASS NUMBER ";Rp(Peak);"  THE CURRENTS ARE"
2450            FOR Steps=Ps(Rp(Peak),2)-3 TO Ps(Rp(Peak),2)+3
2460            Pea(Cc)=Sums(Steps+14)
2470            Cc=Cc+1
2480            PRINT USING "DDDD,3X,MD.DDDE";Steps,Sums(Steps+14)
2490            NEXT Steps
2500            MAT SORT Pea(*)
2510            Avepeak=(Pea(6)+Pea(7))/2
2520            IF Avepeak>6.4E-11 THEN Avepeak=(Pea(5)+Pea(6))/2
2530            PRINT "THE AVE PEAK CURRENT FOR ";Rp(Peak);"  IS ";Avepeak
2540      !     GOTO 2450  ! REMOVE FOR MANUAL CHECK
2550            CONTROL KBD,2;1
2560            LOOP
2570            ON KEY 1 LABEL "CURR OK" GOTO 2640
2580            ON KEY 2 LABEL "" GOTO 2560
2590            ON KEY 3 LABEL "" GOTO 2560
2600            ON KEY 4 LABEL "MOD CURR" GOTO 2620
2610            END LOOP
2620            INPUT "INPUT CORRECT CURRENT ",Avepeak
2630            PRINT "THE AVE PEAK CURRENT FOR ";Amu;"  IS ";Avepeak
2640            Peaks(Jj,Peak)=Avepeak
2650         !  PRINT USING "///"
2660            NEXT Peak
2670                        RETURN
2680 Peakplot:!  ************************************************************
2690                                GCLEAR
2700              Xmax=Num_scan*5
2710           !  Xmax=Peaks(Num_scan,12)
2720              Xmin=0
2730           !  Xmin=Peaks(1,12)
2740           Reftime=Peaks(1,12)
2750              Ymax=-9
2760              Ymin=-15
2770              WINDOW Xmin-(.1*(Xmax-Xmin)),Xmax+.1*(Xmax-Xmin),Ymin+.1*(Ymax-Y
nin),Ymax+.1*(Ymax-Ymin)
2780              FRAME
2790              AXES 5,1,Xmin,Ymin
2800              AXES 5,1,Xmax,Ymax
2810              FOR Am=1 TO 11
2820              IF Peaks(1,Am)=0 THEN 2890
2830              MOVE Peaks(1,12)-Reftime,LGT(Peaks(1,Am))
2840              FOR I=1 TO Num_scan
2850              IF Peaks(I,Am)=0 THEN 2870
2860              DRAW Peaks(I,12)-Reftime,LGT(Peaks(I,Am))
2870              NEXT I
2880              PAUSE
2890              NEXT Am
2900              !
2910              RETURN
2920 Englabel:!  ************************************************************
2930           ! PRODUCE SIDE LABEL FOR ENG WORDS
2940           LORG 1
2950           CSIZE 3
2960           MOVE -5,-9.2
```

```
2970          LABEL "SUMS"
2980          LABEL ""
2990          LABEL "SERIAL";Sums(1)
3000          LABEL ""
3010          LABEL "FILE ";Sums(2)
3020          LABEL ""
3030          LABEL "INDEX";Sums(3)
3040          LABEL ""
3050          LABEL "SCANS";Sums(4)
3060          LABEL ""
3070          LABEL "SCAN ";Sums(5)
3080          LABEL ""
3090          LABEL "INT";Sums(6)
3100          LABEL ""
3110          LABEL "DAY";Sums(7)
3120          LABEL ""
3130          LABEL "HOUR";Sums(8)
3140          LABEL ""
3150          LABEL "MIN";Sums(9)
3160          LABEL ""
3170          LABEL "SEC ";Sums(10)
3180          LABEL ""
3190          LABEL "MSEC";Sums(11)
3200          LABEL ""
3210          LABEL "PREAMP";Sums(12)
3220          LABEL ""
3230          LABEL "SOURCE";Sums(13)
3240          RETURN
3250 Peakstore: !
3260            Peak$="PK_ENT35A"
3270            MASS STORAGE IS ":,700,1"
3280            Filesize=96     !8*12
3290            CREATE BDAT Peak$,Num_scan,96
3300            ASSIGN @Ab TO Peak$
3310            OUTPUT @Ab;Peaks(*)
3320            MASS STORAGE IS ":,700,0"
3330  RETURN
3340 End: !
3350      END
3360   SUB Clear  ! SUB TO Clear Screen
3370   OUTPUT 2 USING "#,B";255,75  ! USE Clear AS A SINGLE STATEMENT
3380   SUBEND
3390  SUB Page
3400  OUTPUT 701;CHR$(12)&CHR$(13)
3410  SUBEND
3420  SUB Dumpscreen
3430   OPTION BASE 1
3440   DIM Pad$[15],Hi$[512]
3450   Pad$=RPT$(CHR$(0),15)
3460     ALLOCATE INTEGER Screen(12480)
3470     GSTORE Screen(*)
3480    OUTPUT 701 USING "K";CHR$(27)&CHR$(42)&CHR$(114)&CHR$(65)
3490   ! ABOVE ENTER RASTER MODE                          ! Esc$=CHR$(27)&"*rA"
3500  Esc$=CHR$(27)&CHR$(42)&CHR$(98)&CHR$(55)&CHR$(57)&CHR$(87)
3510  PRINT Esc$  ! ABOVE TRANSFER ONE RASTER ROW
3520  FOR Row=1 TO 390
3530  Hi$=""
3540  FOR Column=0 TO 31
3550  Index=Row*32-Column
3560  Aa=INT(Screen(Index)/256)
```

```
3570  Bb=INT(Screen(Index) MOD 256)
3580  Hi$=CHR$(Aa)&CHR$(Bb)&Hi$ !&CHR$(B) !HIGH BYTE &LO BYTE
3590  NEXT Column
3600  OUTPUT 701 USING "K";Esc$&Pad$&Hi$
3610  NEXT Row
3620  OUTPUT 701 USING "K";CHR$(27)&"*rB"
3630  SUBEND
3640     SUB Config36(Program$,Data$)
3650     DISP
3660     CONTROL KBD,2;1
3670     DISP "SELECT OPTION";
3680     LOOP
3690     ON KEY 0 LABEL "PROGRAM" GOTO 3670
3700     ON KEY 1 LABEL "INT,0" GOTO Pinternal0
3710     ON KEY 2 LABEL "INT,1" GOTO Pinternal1
3720     ON KEY 3 LABEL "700,0" GOTO P7000
3730     ON KEY 4 LABEL "700,1" GOTO P7001
3740     ON KEY 5 LABEL "DATA " GOTO 3680
3750     ON KEY 6 LABEL "INT,0" GOTO Dinternal0
3760     ON KEY 7 LABEL "INT,1" GOTO Dinternal1
3770     ON KEY 8 LABEL "700,0" GOTO D7000
3780     ON KEY 9 LABEL "700,1" GOTO D7001
3790     END LOOP
3800 Pinternal0:    !
3810                Program$=":INTERNAL4,0"
3820                GOTO Subend
3830 Pinternal1:                !
3840               Program$=":INTERNAL4,1"
3850               GOTO Subend
3860 P7000:       Program$=":,700,0"
3870      GOTO Subend
3880 P7001:       !
3890             Program$=":,700,1"
3900             GOTO Subend
3910 Dinternal0:   !
3920               Data$=":INTERNAL4,0"
3930               GOTO Subend
3940 Dinternal1: !
3950             Data$=":INTERNAL,4,1"
3960             GOTO Subend
3970 D7000:       Data$=":,700,0"
3980             GOTO Subend
3990 D7001:!
4000           Data$=":,700,1"
4010           GOTO Subend
4020 Subend: !
4030         BEEP
4040         Flag=Flag+1
4050         IF Flag=2 THEN 4090
4060         DISP
4070         DISP "SELECT NEXT OPTION";
4080         IF Flag<=1 THEN 3680
4090         PRINT "PROGRAM MSI IS ";Program$
4100         PRINT "DATA MSI IS ";Data$
4110         SUBEND
4120      SUB Config320(Program$,Data$)
4130      CONTROL KBD,2;1
4140  DISP
4150  DISP "SELECT OPTION";
4160  LOOP
```

```
4170  ON KEY 1 LABEL "PROGRAM" GOTO 4140
4180  ON KEY 2 LABEL "" GOTO 4160
4190  ON KEY 3 LABEL "" GOTO 4160
4200  ON KEY 4 LABEL "" GOTO 4160
4210  ON KEY 5 LABEL "704,0" GOTO Pinternal0
4220  ON KEY 6 LABEL "704,1" GOTO Pinternal1
4230  ON KEY 7 LABEL "700,0" GOTO Php0
4240  ON KEY 8 LABEL "700,1" GOTO Php1
4250  ON KEY 9 LABEL "DATA" GOTO 4140
4260  ON KEY 10 LABEL "" GOTO 4160
4270  ON KEY 11 LABEL "" GOTO 4160
4280  ON KEY 12 LABEL "" GOTO 4160
4290  ON KEY 13 LABEL "704,0" GOTO Dinternal0
4300  ON KEY 14 LABEL "704,1" GOTO Dinternal1
4310  ON KEY 15 LABEL "700,0" GOTO Dhp0
4320  ON KEY 16 LABEL "700,1" GOTO Dhp1
4330  END LOOP
4340 Pinternal0: !
4350             Program$=":,704,0"
4360             GOTO End
4370 Pinternal1: !
4380             Program$=":,704,1"
4390             GOTO End
4400 Php1:        !
4410             Program$=":,700,1"
4420             GOTO End
4430 Php0:        !
4440             Program$=":,700,0"
4450             GOTO End
4460 Dinternal0: !
4470             Data$=":,704,0"
4480             GOTO End
4490 Dinternal1: !
4500             Data$=":,704,1"
4510             GOTO End
4520 Dhp1:        !
4530             Data$=":,700,1"
4540             GOTO End
4550 Dhp0:        !
4560             Data$=":,700,0"
4570             GOTO End
4580 End: !
4590      BEEP
4600      Flag=Flag+1
4610      IF Flag=2 THEN 4660
4620      DISP
4630      DISP "SELECT NEXT OPTION";
4640      CONTROL KBD,2;2
4650      IF Flag<=1 THEN 4160
4660      DISP
4670      CONTROL KBD,2;1
4680      SUBEND
```

ATTACHMENT D - SUMS SOFTWARE LISTING

(5) PLOT8:

```
10!   RE-STORE   "PLOT8"
20  ! RJD REVISION  6/28/91
30*
40  ! REVISED FOR HP 320 SERIES   OR 9836
50  ! REQUIRES KET BDAT ON SAME DISK
60  VIEWPORT 0,100,0,80
70  !AND FOR _________ KEYBOARD
80      OPTION BASE 1
90  !   LOAD KEY "KEY"
100 !   CONTROL KBD,2;0    ! 0 SYSTEM,1 USER 1,2 USER 2, 3 USER 3
110     DIM Cat$(1)[80]
120     DIM Dat(11000,2)
130     DIM A$[80],B$[80],C$[8],D$(10)[80],E$[100],Eq$[80],Program$[15],Data$[15
]
140     DIM Temp(11000,2),Pl(10)
150     DIM D(253),E(22)
160*
170   Intprint
180   ON ERROR GOTO 210     !TURNS ERROR DETECTED IN 71 IF SUB NOT PRESENT
190   DEG
200   DELSUB Equation    !  IF SUB LEFT ON PROGRAM THIS DEL THE SUB
210   OFF ERROR
220   Aclear
230   Config36(Program$,Data$)
240 ! Config320(Program$,Data$)
250   DISP
260   DISP "INSTRUCTION NEEDED";
270   Yesno(R5)
280   ON R5 GOTO 290,480,250
290   PRINT "                  GENERAL PLOT PROGRAM "
300   PRINT "IF EQUATION IS TO BE PLOTTED THEN THE EQUATION IS STORED ON A SEPER
ATE FILE"
310   PRINT "EQUATIONS ARE STORED ON  "&Program$&" SEE EQUAT FOR A SIMPLE EXAMPL
E"
320   PRINT
330   PRINT "YOU MAY ALSO COMPARE A DATA SET TO AN EQUATION (EQUAT)"
340   PRINT "THIS OPTION GIVES STAT OF DATA TO THE EQUATION (EQUATDAT)"
350   PRINT
360   PRINT "This is a general plotting program for up to 8 plots "
370   PRINT "You are allowed up to 5000 points per plot(DAT(5000,2)"
380   PRINT "AXIS Label or Identification is auto centered"
390   PRINT
400   PRINT "ONLY ONE SET OF DATA IS RETAINED IN MEMORY "
410   PRINT "USE STORE OPTION IF YOU WISH TO SAVE AND RECALL DATA INPUTS"
420   PRINT "IN THE STORE/RECALL MODE REC/FILE = NUM OF DATA POINTS "
430   PRINT "DATA IS STORED OR RECALLED FROM "&Data$
440   PRINT
450   PRINT "PROGRAM MSI IS ";Program$;"   DATA MSI IS  ";Data$
460   PRINT "                       PRESS CONTINUE WHEN READY"
470   PAUSE
480   Aclear
490   DISP
500   DISP "COMPARE A DATA SET TO AN EQUATION";
510   Yesno(R5)
520   ON R5 GOTO 530,540,490
530   Compare(D(*),Eq$,Std_dev)
540   GINIT
550   GCLEAR
560 ! REVISION   5/9/86
570   G1=1
```

```
580   Pu=0
590   IF More_graph=1 THEN 610
600   L5=0
610   DISP
620   DISP "STANDARD PLOTTER P1 P2 SETTING ";
630   Yesno(R5)
640   ON R5 GOTO 650,670,610
650   PRINTER IS 705
660   PRINT "IP1016,1016,10160,7620"    !SETS STANDARD SIZE FOR VIEWGRAPH
670   Intprint       ! INTERNAL PRINTER
680 ! Plotter(Pen,Vel)   !PEN 0 ,PENSPEED
690   Intplot         !INTERNAL PLOTTER
700   PEN 1
710   DISP
720   DISP "INPUT DATA FROM FILES";
730   Yesno(R5)
740   Aclear
750   ON R5 GOTO 760,770,720
760   GOSUB Dataread
770   IF More_graph=0 THEN 820
780   DISP
790   DISP "SAME TYPE PLOT"
800   Yesno(R5)
810   ON R5 GOTO 840,820,780
820   Typeplot(L5)
830   IF More_graph=0 THEN 880
840   DISP
850   DISP "SAME AXIS     ";
860   Yesno(R5)
870   ON R5 GOTO 900,880,840
880   Axesin(X1,X2,Y1,Y2,T1,T2,T3,T4,L5)
890   IF More_graph=0 THEN 940
900   DISP
910   DISP "SAME AXIS LABELS";
920   Yesno(R5)
930   ON R5 GOTO 950,940,900
940   Labelin(A$,B$)                          ! YES,NO,NEITHER
950   CSIZE 2,.6
960   LDIR 0
970 Window_set:!                             ! THESE LINES CREATES A
980   X3=X1-.1*(X2-X1)                       ! THESE LINES CREATES A
990   X4=X2+.1*(X2-X1)                       ! 10 % AREA FOR PLOT LABELS
1000  X5=X4-X3
1010  Y3=Y1-.2*(Y2-Y1)                       ! AND NUMBERING THE AXIS
1020  Y4=Y2+.1*(Y2-Y1)
1030  Y5=Y4-Y3
1040  Aclear
1050  WINDOW X3,X4,Y3,Y4
1060  Open_plot(Open)
1070  Plotgraph(X1,X2,X3,X4,Y1,Y2,Y3,Y4,T1,T2,T3,T4,A$,B$,L5,Open)
1080  DISP
1090  DISP "PLOT AN EQUATION "
1100  Yesno(R5)
1110  ON R5 GOTO 1120,1190,1080
1120  CAT
1130  DISP
1140  Plotequation(Xmin,Xmax,Deltax)
1150  DISP
1160  DISP " ANY MORE EQUATIONS"
1170  Yesno(R5)
```

```
1180  ON R5 GOTO 1120,1190,1150
1190  DISP
1200  DISP "How Many Plots for this Graph";
1210  Entry1(Q1,R5)
1220  ON R5 GOTO 1230,1190,1190
1230  Ngraph=Q1                                    !NUMBER OF PLOTS SELECTED
1240  IF Ngraph=0 THEN End
1250  IF Ngraph<=10 THEN 1320
1260  BEEP
1270  DISP
1280  DISP " Number of plots limited to 10"
1290  WAIT 2
1300  BEEP
1310  GOTO 1190
1320  FOR Graph=1 TO Ngraph+1 STEP 1
1330  IF Graph=Ngraph+1 THEN 2170
1340  IF Dfile=1 THEN 1740
1350  DISP
1360  DISP " PLOT DATA ON FILE"                   !DATA DISC MUST BE IN 2
1370  Yesno(R5)
1380  IF R5=1 THEN GOSUB Dataread!     CAT ON DATA
1390  IF Dfile=1 THEN 1740
1400  IF R5=2 THEN 1410
1410  IF Graph=1 THEN 1480
1420   DISP
1430  DISP "WILL X VALUES REPEAT FOR PLOT",Graph;   !REPEATS X VALUE FROM PREVIO
US PLOT
1440  Yesno(R5)
1450  ON R5 GOTO 1460,1480,1420
1460  Xrep=1
1470  GOTO 1630
1480  DISP
1490  DISP "How Many Points for this Plot",Graph; !NUMBER OF POINTS FOR PLOT
1500  Entry1(Q1,R5)                                  ! SINGLE ENTRY AND CHECK10
1510  ON R5 GOTO 1520,1480,1480
1520  Xrep=0
1530  Npts=Q1
1540  IF Npts=0 THEN 2160
1550  IF Npts<=1000 THEN 1630
1560  DISP
1570  DISP " Number Limited to 1000"
1580  BEEP
1590  WAIT 1
1600  BEEP
1610!
1620 GOTO 1480
1630 DISP
1640 DISP "Input Description of Data";
1650 LINPUT E$
1660 FOR I=1 TO Npts STEP 1
1670 IF Xrep=1 THEN 1710
1680 DISP "Input X,Y Point Number ",I;
1690 INPUT Dat(I,1),Dat(I,2)
1700 GOTO 1730
1710 DISP "FOR X=";Dat(I,1);"input Y point number ",I;
1720 INPUT Dat(I,2)
1730 NEXT I
1740 Dfile=0
1750 PRINT "DESCRIPTION OF DATA INPUT"
1760 PRINT E$
```

```
1770 PRINT "Data input for Plot number",Graph
1780 PRINT " I"," X"," y"
1790 IF Pr=1 THEN 1810
1800  Datacheck(Dat(*),Npts)
1810 PRINTER IS 1
1820 Pr=0
1830 GOSUB Datastore
1840  DISP
1850  DISP "Want to Connect the Data Points";
1860 Yesno(R5)
1870 ON R5 GOTO 1880,1900,1840
1880 H=-1                                   !PEN CONTROL PARAMETER
1890 GOTO 1910
1900 H=-2
1910 DISP
1920 DISP "Do You Wish to Plot Symbols";
1930 Yesno(R5)
1940 ON R5 GOTO 1950,1970,1910
1950 Symbol(Symbol)
1960 GOTO 1980
1970 Symbol=0
1980 PENUP
1990 FOR I=1 TO Npts STEP 1
2000 X=Dat(I,1)*(L5<=1)+LGT((L5<=1)+Dat(I,1)*(L5>1))
2010 Y=Dat(I,2)*(L5=0 OR L5=2)+LGT((L5=0 OR L5=2)+Dat(I,2)*(L5=1 OR L5=3))
2020 PLOT X,Y,-H
2030 IF Symbol=0 THEN 2050
2040  Plot_symbol(X5,Y5,Symbol,H)
2050 NEXT I
2060 LORG 1
2070 PENUP
2080 IF Pu=1 THEN 2110
2090 GOSUB Plotselect
2100 IF Plotter=705 THEN 1990
2110 GOTO Poly      !  POLY
2120 IF Pu=1 THEN 2130
2130 Intplot
2140 Plotter=0
2150 Pu=0
2160 NEXT Graph
2170 BEEP 407,1
2180 WAIT .5
2190 BEEP 490,1
2200 LDIR 0
2210 DISP
2220 DISP "Wish to Identify the Plots";
2230 Yesno(R5)
2240 ON R5 GOTO 2250,2670,2210
2250 PRINT "Input Location of Start of Curve Description"
2260  PRINT "Remember to Leave Space for all Curves"
2270  PRINT "Both Horiz and Vert"
2280   BEEP
2290  DISP
2300   DISP "Input X,Y Location of Curves ";
2310   INPUT X,Y
2320   IF L5=0 THEN 2410
2330   IF L5=2 THEN 2360
2340   IF L5=3 THEN 2360
2350   GOTO 2370
2360   X=LGT(X)
```

```
2370   IF L5=1 THEN 2400
2380   IF L5=3 THEN 2400
2390   GOTO 2410
2400   Y=LGT(Y)
2410   FOR Graph=1 TO Ngraph STEP 1
2420   IF Pu=1 THEN 2480
2430         Symbol(Symbol)
2440         Pl(Graph)=Symbol
2450   DISP
2460    DISP "Input Curve Description for Plot Number",Graph;
2470   LINPUT D$(Graph)
2480   PLOT X,Y-(Graph-1)*.035*Y5,-2
2490   IF Pu=1 THEN Symbol=Pl(Graph)
2500   IF Symbol=0 THEN 2560
2510   Plot_symbol(X5,Y5,Symbol,H)
2520   CSIZE 2.5,.6
2530   IF Graph=8 THEN 2550
2540   GOTO 2560
2550   PLOT X,Y-(Graph-1)*.035*Y5,-2
2560   LORG 2
2570   LABEL " = ";D$(Graph)
2580   LORG 1
2590   PENUP
2600   NEXT Graph
2610   IF Pu=1 THEN 2640
2620   GOSUB Plotselect
2630   IF Plotter=705 THEN 2410
2640   Plotter=0
2650   Pu=0
2660   Intplot
2670  DISP
2680  DISP "Wish a 2 line Description accross the top";
2690  Yesno(R5)
2700  ON R5 GOTO 2710,3060,2670
2710   PRINT "Input First Line of Heading Note"
2720   PRINT " The Heading Will be AUTO CENTERED    "
2730   PRINT " and will Appear as Typed in , Including All spaces"
2740   PRINT "COMMAS ARE NOT ALLOWED IN INPUT"
2750   BEEP
2760   FOR J=1 TO 2
2770   IF Pu=1 THEN 2910
2780   DISP
2790   DISP " Enter Line Number ",J;
2800   LINPUT D$(J)
2810   !
2820   U1=LEN(D$(J))
2830   IF U1<=75 THEN 2900
2840  PRINT " LINE IS TOO LONG BY :",U1-75
2850  PRINT (D$(J))
2860  PRINT "LINE IS LIMITED TOO:"
2870  PRINT D$(J)[1,75]
2880   BEEP
2890   GOTO 2780
2900   CSIZE 3,.6
2910 ! PLOT X1+.05*(X2-X1),Y2+(.10-(J*.04))*(Y2-Y1),-2 ! START AT LEFT SIDE
2920   PLOT (X1+X2)/2,Y2+(.10-(J*.04))*(Y2-Y1),-2      ! AUTO CENTER OF PLOT
2930   LORG 5                                          !COMMAND TO CENTER PLOT
2940   LABEL (D$(J))
2950   LORG 1                                          !NORMAL STATUS OF LORG
2960   PENUP
```

```
2970  NEXT J
2980  IF Pu=1 THEN 3010
2990  GOSUB Plotselect
3000  IF Pu=1 THEN 2760
3010  Plotter=0
3020  Pu=0
3030  PEN 0
3040  Intplot
3050  PEN 1
3060  DISP
3070  DISP "WANT TO PLOT 1 LINES ACCROSS THE BASE ";
3080   Yesno(R5)
3090   ON R5 GOTO 3100,3340,3070
3100   PRINT "Input Line of BASE Note"
3110   PRINT " The BASE  Will be AUTO CENTERED   "
3120   PRINT " and will Appear as Typed in , Including All spaces"
3130   PRINT "LIMIT OF BASE INPUT IS 30"
3140   BEEP
3150   D$(1)=""
3160   D$(2)=""
3170   !
3180   IF Pu=1 THEN 3240
3190   DISP
3200   DISP " Enter BASE LABEL  ";
3210   LINPUT D$(1)
3220   IF LEN(D$(1))>30 THEN 3100
3230   CSIZE 6,.6
3240 ! PLOT X1+.05*(X2-X1),Y1+(-.10-(J*.04))*(Y2-Y1),-2 ! START AT LEFT SIDE
3250 ! LORG 2
3260   PLOT (X1+X2)/2,Y3                                  ! AUTO CENTER OF PLOT
3270   LORG 4                                            !COMMAND TO CENTER PLOT
3280   LABEL (D$(1))
3290   LORG 1                                            !NORMAL STATUS OF LORG
3300   PENUP
3310  IF Pu=1 THEN 3340
3320  GOSUB Plotselect
3330  IF Pu=1 THEN 3170
3340  Plotter=0
3350  Pu=0
3360  PLOTTER IS 3,"INTERNAL"
3370   DISP
3380   DISP "Wish to Plot A Message";
3390   Yesno(R5)
3400   ON R5 GOTO 3410,3840,3370
3410    DISP
3420    DISP " Input Percent of Small Scale";
3430   Entry1(Q1,R5)
3440   ON R5 GOTO 3450,3410,3410
3450   F=Q1
3460   DEG
3470    DISP
3480    DISP "at What Angle";
3490   Entry1(Q1,R5)
3500   ON R5 GOTO 3510,3470,3470
3510  Angle=Q1
3520   DISP
3530   DISP "Input Message Location";
3540  Entry2(Q1,Q2,R5)
3550  ON R5 GOTO 3560,3510,3510
3560   X=Q1
```

```
3570   Y=Q2
3580   IF L5=0 THEN 3650
3590   IF L5=1 THEN 3640
3600   IF L5=2 OR L5=3 THEN 3610
3610   X=LGT(X)
3620   IF L5=1 OR L5=3 THEN 3640
3630   GOTO 3650
3640   Y=LGT(Y)
3650   PLOT X,Y,-2
3660   IF Pu=1 THEN 3700
3670   DISP
3680   DISP "Input Message";
3690   LINPUT D$(1)
3700   CSIZE F,.6
3710   LDIR Angle
3720   LORG 5
3730   LABEL (D$(1))
3740   PENUP
3750   IF Pu=1 THEN 3780
3760   GOSUB Plotselect
3770   IF Pu=1 THEN 3650
3780   Pu=0
3790   Intplot
3800   DISP
3810   DISP " Any More Messages";
3820   Yesno(R5)
3830   ON R5 GOTO 3410,3840,3800
3840   G1=0
3850   DISP
3860   DISP "Want More Graphs";
3870   Yesno(R5)
3880   ON R5 GOTO 3900,3890,3850
3890   GOTO End
3900   Plotter=0
3910   PEN 0
3920   Intplot
3930   PEN 1
3940   More_graph=1
3950   GOTO 10
3960   PAUSE
3970 Poly:  !
3980   REM*************************************************************************
3990 REM    ******************REGRESSION ANALYSIS    ***********************
4000 REM*************************************************************************
4010   Datacheck(Dat(*),Npts)
4020   Second=0
4030   Intplot
4040    Plotter=0
4050    Pu=0
4060    DISP
4070    DISP "Do You Wish A Polynomial Regression of the Data";
4080   BEEP
4090   WAIT 1
4100   BEEP
4110   Yesno(R5)
4120   ON R5 GOTO 4140,4130,4010
4130   GOTO 2120
4140   MAT D= D*(0)
4150   MAT E= E*(0)
4160   E(1)=1
```

```
4170   W=0
4180   Do=0
4190 S1=0
4200   S2=0
4210   S3=0
4220   S4=0
4230   S5=0
4240   IF Second=1 THEN 4360
4250  PRINT "N+1 Data Points Required for Max Degree of N"
4260  PRINT "Run Time is in Direct Relation to Max Degree Value"
4270  PRINT "Max Degree program  Allows  is 20!"
4280   BEEP
4290  PRINT "Input Max Degree for this plot is";Npts-1
4300  DISP
4310  DISP "INPUT Degree fit for this Plot";
4320  Entry1(Q1,R5)
4330  ON R5 GOTO 4340,4310,4310
4340        D1=Q1
4350   D2=D1
4360  PRINT "Dgree selected was";D2
4370  IF D2>=Npts THEN 4250
4380   BEEP
4390          IMAGE DDDD,2DDDDDDDDDDDD.DDDD
4400         IMAGE  2DDDDDDDDDDDD.DDDD
4410   FOR M=1 TO Npts STEP 1
4420   IF L5=2 THEN 4460
4430   IF L5=3 THEN 4460
4440   E(2)=Dat(M,1)     !A(G,M)
4450   GOTO 4470
4460   E(2)=LGT(Dat(M,1))     !LGT(A(G,M))
4470   IF L5=1 THEN 4510
4480   IF L5=3 THEN 4510
4490   Y=Dat(M,2)             !B(G,M)
4500   GOTO 4520
4510   Y=LGT(Dat(M,2))        !LGT(B(G,M))
4520   FOR I=2 TO D2
4530   E(I+1)=E(I)*E(2)
4540   NEXT I
4550   E(D2+2)=Y
4560   R=0
4570   FOR I=1 TO D2+2
4580   FOR J=I TO D2+2
4590   R=R+1
4600   D(R)=D(R)+E(I)*E(J)
4610   NEXT J
4620   NEXT I
4630   S1=S1+E(2)
4640   S2=S2+E(2)^2
4650   S3=S3+Y
4660   S4=S4+Y*Y
4670   S5=S5+E(2)*Y
4680   Do=Do+1
4690   NEXT M
4700   S8=SQR((S2-S1^2/Do)/(Do-1))    !STD DEV OF X
4710   S9=SQR((S4-S3^2/Do)/(Do-1))    !STD DEV OF Y
4720   R9=(S5-S1*S3/Do)/(Do-1)/S8/S9 !CORR COEFF OF SET X,Y
4730   P=1
4740   W=1
4750   D2=D2+1
4760   FOR J=1 TO D2
```

```
4770   IF D(P)<0 THEN 6870
4780   D(P)=SQR(D(P))
4790   FOR I=1 TO D2-J+1
4800   D(P+I)=D(P+I)/D(P)
4810   NEXT I
4820   R=P+I
4830   S=R
4840   FOR L=1 TO D2-J
4850   P=P+1
4860   FOR M=1 TO D2+2-J-L
4870   D(R+M-1)=D(R+M-1)-D(P)*D(P+M-1)
4880   NEXT M
4890   R=R+M-1
4900   NEXT L
4910   P=S
4920   NEXT J
4930   T=(D2+1)*(D2+2)/2
4940   FOR I=1 TO D2-1
4950   T=T-1-I
4960   D(T)=1/D(T)
4970   FOR J=1 TO D2-I
4980   P=D2+1-I-J
4990   P=P*(D2+1-(P-1)/2)-I
5000   R=P-J
5010   S=0
5020   U=I+J+1
5030   V=P
5040   FOR K=1 TO J
5050   V=V+U-K
5060   S=S-D(R+K)*D(V)
5070   NEXT K
5080   D(P)=S/D(R)
5090   NEXT J
5100   NEXT I
5110   D(1)=1/D(1)
5120   T=0
5130   FOR I=1 TO D1+1
5140   E(I)=0
5150   FOR J=1 TO D1-I+2
5160   R=(I+J-1)*(D2+2-.5*(I+J))
5170   E(I)=E(I)+D(T+J)*D(R)
5180   NEXT J
5190   T=I*(D2+(3-I)/2)
5200   NEXT I
5210   R1=0
5220   FOR I=2 TO D1+1
5230   R1=R1+D(I*(D2+(3-I)/2))^2
5240   NEXT I
5250   T0=D((D2+1)*(D2+2)/2)
5260   T0=T0-(D(D2+1))^2
5270   PRINT "COEFFICIENTS FOR PLOT ",Graph
5280   PRINT "DATA FROM  ";File$
5290   PRINT "DATA DESCRIPTION ";E$
5300   PRINT
5310   ON L5+1 GOTO 5320,5340,5360,5380   !L5+1 SINCE L5 STARTS AT 0
5320   PRINT "      y = AX^2 + BX^1 + C"
5330   GOTO 5390
5340   PRINT "      LGT(Y) = AX^2 + BX^1 + C "
5350   GOTO 5390
5360   PRINT "      Y = A(LGT X)^2 + B(LGT X)^1  + C"
```

```
5370   GOTO 5390
5380   PRINT "       LGT(Y) = A(LGT X)^2 + B(LGT X)^1 + C"
5390   PRINT "  "
5400   IMAGE         DDD ; DDDDDDDDDDDD.DDDD
5410   FOR I=1 TO D1+1
5420   PRINT "E(";I-1;")=  ";E(I)
5430   NEXT I
5440   DISP
5450   DISP "WANT TO DETERNMINE X WHERE Y=0  VALUE OF POLY";
5460   Yesno(R5)
5470   ON R5 GOTO 5490,5480,5440
5480   GOTO 5500
5490   Detzero(E(*),D1,L5,Yvalue)
5500   PRINT "R SQUARED = ";R1/T0
5510   Sumdiff=0
5520   Sumsq=0
5530   FOR I=1 TO Npts
5540   X=Dat(I,1)*(L5<=1)+LGT(Dat(I,1)*(L5>1)+(L5<=1))
5550   Y=E(D1+1)
5560   FOR J=D1 TO 1 STEP -1
5570   Y=Y*X+E(J)
5580   NEXT J
5590   Y=Y*(L5=0 OR L5=2)+10^Y*(L5=1 OR L5=3)
5600 ! PRINT X,Y,Dat(I,2)-Y
5610   Sumdiff=Sumdiff+(Dat(I,2)-Y)
5620   Sumsq=Sumsq+(Dat(I,2)-Y)*(Dat(I,2)-Y)
5630   NEXT I
5640   Std_dev=((Sumsq-(Sumdiff*Sumdiff)/Npts)/(Npts-1))^.5
5650   PRINT "STD DEV  OF Y -YCAL =  ";Std_dev
5660   GOTO Bypass_stat
5670   PRINT "STASTICS FOR PLOT ";Graph
5680   PRINT "  "
5690   PRINT "NUMBER OF POINTS = ";Do
5700   PRINT "  "
5710   PRINT "X:  MEAN = ";S1/Do;"      ";"ST. DEV. =";S8
5720   PRINT "Y   MEAN = ";S3/Do;"      ";"ST. DEV. =";S9
5730   PRINT "   "
5740   PRINT "CORR. COEFF.. = ";R9
5750 Bypass_stat:  !
5760   PRINT "  "
5770   PRINT "TABLE FOR PLOT";Graph
5780   PRINT "  "
5790   PRINT "              X             Y             CAL Y         Y-CAL Y
    SIGMA"
5800   E5=0
5810   FOR M=1 TO Npts
5820   IF L5>1 THEN 5850
5830   I=Dat(M,1)                    !A(G,M)
5840   GOTO 5860
5850   I=LGT(Dat(M,1))               !LGT(A(G,M))
5860   Y=E(D1+1)
5870   FOR J=D1 TO 1 STEP -1
5880   Y=Y*I+E(J)
5890   NEXT J
5900   IF L5=1 OR L5=3 THEN 5930
5910   PRINT USING 5940;M,Dat(M,1),Dat(M,2),Y,Y-Dat(M,2),(Y-Dat(M,2))/Std_dev
5920   GOTO 5960
5930   PRINT USING 5940;M,Dat(M,1),Dat(M,2),10^Y,Dat(M,2)-10^Y,(Dat(M,2)-10^Y)/S
td_dev
5940   IMAGE DDDDD,5X,SD.3DE,5X,SD.3DE,5X,SD.3DE,5X,SD.3DE,5X,DD.DD
```

```
5950    IMAGE 3X,  SD.3DE,9X,SD.3DE,5X,SD.3DE,5X,SD.3DE,DDDDDD.DDD,5X,DDD.DDD
5960    IF L5=1 OR L5=3 THEN 5990
5970    E4=(Dat(M,2)-Y)*(Dat(M,2)-Y)                !(B(G,M)-Y)^2
5980    GOTO 6000
5990    E4=(Dat(M,2)-10^Y)*(Dat(M,2)-10^Y)          !(B(G,M)-10^Y)^2
6000    E5=E5+E4
6010    NEXT M
6020    E6=(E5/(Do-1))^.5
6030 !  PRINT "STD DEV OF Y-Y CAL = ";E6
6040    PRINT "  "
6050    IF Pr=1 THEN 6080
6060    GOSUB Hardcopy
6070    IF Pr=1 THEN 5270
6080     Pr=0
6090     PRINTER IS 1
6100     DISP
6110     DISP " PLOT THE EQUATION";
6120    Yesno(R5)
6130    ON R5 GOTO 6140,6530,6110
6140     IF L5<2 THEN 6260
6150     DISP
6160     DISP "INPUT Xmin,Xmax,NUMBER OF POINTS PER DECADE";
6170    Entry3(Q1,Q2,Q3,R5)
6180    ON R5 GOTO 6190,6160,6160
6190    Ao=Q1
6200    Bo=Q2
6210    C=Q3
6220     Ao=LGT(Ao)
6230     Bo=LGT(Bo)
6240     C=1/C
6250     GOTO 6330
6260     DISP
6270      DISP " INPUT Xmin,Xmax,STEP";
6280     Entry3(Q1,Q2,Q3,R5)
6290     ON R5 GOTO 6300,6270,6270
6300           Ao=Q1
6310           Bo=Q2
6320           C=Q3
6330     PENUP
6340     FOR I=Ao TO Bo STEP C
6350     Y=E(D1+1)
6360     FOR J=D1 TO 1 STEP -1
6370     Y=Y*I+E(J)
6380     NEXT J
6390     PLOT I,Y,1
6400     NEXT I
6410     PENUP
6420     IF Pu=1 THEN 6490
6430     DISP
6440      DISP "is Fit OK";
6450     Yesno(R5)
6460     ON R5 GOTO 6470,4010,6300
6470     GOSUB Plotselect
6480     IF Plotter=705 THEN 6340
6490     Intplot
6500     Plotter=0
6510     Pu=0
6520     DISP
6530      DISP "WANT SELECTED PRINT OUT";
6540     Yesno(R5)
```

```
6550     ON R5 GOTO 6560,6850,6470
6560     DISP
6570     DISP "INPUT Xmin,XMax,STEP";
6580     Entry3(Q1,Q2,Q3,R5)
6590     ON R5 GOTO 6600,6560,6560
6600           Ao=Q1
6610           Bo=Q2
6620           C=Q3
6630     FOR I=Ao TO Bo STEP C
6640     X=I
6650     IF L5>1 THEN X=LGT(X)       ! COEFFICIENTS IN EQ ARE IN LGT
6660     Y=E(D1+1)
6670     FOR J=D1 TO 1 STEP -1
6680     Y=Y*X+E(J)
6690     NEXT J
6700     IF L5=0 THEN 6740
6710     IF L5=1 THEN 6760
6720     IF L5=2 THEN 6780
6730     IF L5=3 THEN 6800
6740     PRINT X,Y
6750     GOTO 6810
6760     PRINT X,10^Y
6770     GOTO 6810
6780     PRINT 10^X,Y
6790     GOTO 6810
6800     PRINT 10^X,10^Y
6810     NEXT I
6820     IF Pr=1 THEN 6850
6830     GOSUB Hardcopy
6840     IF Pr=1 THEN 6630
6850     PRINTER IS 1
6860     GOTO 2120
6870     DISP
6880     DISP " D(P)  NEGATIVE Will Reprocess at the next lower Fit";
6890     D1=D1-1
6900     D2=D1
6910     Second=1
6920     GOTO 4140
6930     PAUSE
6940 Plotselect:          !*****************************************************
******************
6950    DISP
6960    DISP " Shall We Put This On The Plotter"
6970   Yesno(R5)
6980   ON R5 GOTO 7010,6990,6960
6990   Intplot
7000   RETURN
7010   Plotter=705
7020   Pu=1
7030   Plotter(Pn,Vel)
7040   RETURN
7050   PAUSE
7060 Hardcopy:    !*****************************************************************
*********
7070    DISP
7080    DISP "Do You Want A Hard Copy of The Information";
7090   Yesno(R5)
7100   ON R5 GOTO 7120,7110,7080
7110   RETURN
7120   Aclear
```

```
7130  PRINTER IS 701
7140  Pr=1
7150  RETURN
7160  REM*************************************************************************
7170 Datastore:  REM DATA STORAGE SUB  ****************************************
********
7180  REM*************************************************************************
7190  DISP
7200   DISP " WANT TO STORE THE DATA";
7210   Yesno(R5)
7220   ON R5 GOTO 7230,7340,7200
7230   INPUT "INPUT FILE NAME",File$
7240   MASS STORAGE IS Data$   ! DATA STORE MSI
7250   CREATE BDAT File$,Npts,16
7260   REDIM Temp(Npts,2)
7270   FOR I=1 TO Npts
7280   Temp(I,1)=Dat(I,1)
7290   Temp(I,2)=Dat(I,2)
7300   NEXT I
7310   ASSIGN @Ab TO File$
7320   OUTPUT @Ab;Temp(*)
7330   MASS STORAGE IS Program$     ! PROGRAM MSI
7340   RETURN
7350  !END
7360  REM*********************************************************
7370 Dataread:    REM DATA READ SUB ***************************************
7380  REM*********************************************************
7390  BEEP
7400  DISP "IS DATA IN THE CORRECT FORM DAT(XXX,2)";
7410  Yesno(R5)
7420  ON R5 GOTO 7450,7430,7400
7430  MASS STORAGE IS Program$
7440  LOAD "DATA_TRANS",1
7450  IF Graph=0 THEN Graph=1
7460  MASS STORAGE IS Data$               ! DATA STORE MSI
7470  DISP
7480  Dataselect(File$)
7490  ON ERROR GOTO 7380
7500  CAT TO Cat$(*);SELECT File$,NO HEADER
7510  Rec_file=VAL(Cat$(1)[38,45])
7520  REDIM Temp(Rec_file,2)
7530  REDIM Dat(Rec_file,2)
7540  ASSIGN @Ab TO File$
7550  ENTER @Ab;Temp(*)
7560  FOR I=1 TO Rec_file
7570  Dat(I,1)=Temp(I,1)
7580  Dat(I,2)=Temp(I,2)
7590  NEXT I
7600  Npts=Rec_file
7610  Minx=9.E+99
7620  Maxx=-9.E+99
7630  Miny=9.E+99
7640  Maxy=-9.E+99
7650  FOR I=1 TO Npts
7660  IF Dat(I,1)<Minx THEN Minx=Dat(I,1)
7670  IF Dat(I,1)>Maxx THEN Maxx=Dat(I,1)
7680  IF Dat(I,2)<Miny THEN Miny=Dat(I,2)
7690  IF Dat(I,2)>Maxy THEN Maxy=Dat(I,2)
7700  NEXT I
7710  PRINT "NUMBER OF DATA POINTS IS  ";Npts
```

```
7720  PRINT "MIN X = ";Minx;"   MAX X =  ";Maxx
7730  PRINT "MIN Y = ";Miny;"   MAX Y =  ";Maxy
7740  Dfile=1
7750  MASS STORAGE IS Program$   ! PROGRAM MSI
7760  OFF ERROR
7770  RETURN
7780 End: !   *********
7790      PEN 0
7800      PLOTTER IS 705,"HPGL"
7810      Intplot
7820      PEN 1
7830      Intprint
7840      MASS STORAGE IS Program$
7850      CONTROL KBD,2;0
7860   !  LOAD "AUTOST",1
7870      END
7880  SUB Entry2(Q1,Q2,R5)
7890  INPUT Q1,Q2
7900  BEEP 440,.5
7910  DISP
7920   DISP "IS INPUTS ";Q1,Q2;" CORRECT";
7930  Yesno(R5)
7940  ON R5 GOTO 8000,7950,7890
7950  BEEP
7960  DISP
7970   DISP "RE-ENTER DATA"
7980  WAIT 1.5
7990  BEEP
8000  SUBEND
8010  SUB Intplot
8020  PLOTTER IS 3,"INTERNAL"
8030  SUBEND
8040  SUB Intprint
8050  PRINTER IS 1
8060  SUBEND
8070  SUB Labelin(A$,B$)
8080  Namelimit=INT((100/5)*(RATIO/.6)*.77)
8090  DISP
8100  DISP "INPUT XAXIS NAME( LABEL) LIMIT  ";Namelimit;
8110  LINPUT A$
8120  L1=LEN(A$)
8130  IF L1<=Namelimit THEN 8210
8140  Long=L1-Namelimit
8150  DISP
8160  DISP "X AXIS NAME IS TO LONG BY ";Long
8170  Print
8180  PRINT "X AXIS LIMITED TO   "&A$[1,Namelimit]
8190  Intprint
8200  GOTO 8100
8210  Namelimit=INT((100*.8/4)/.6)
8220  DISP
8230  DISP "INPUT YAXIS NAME (LABEL) LIMIT IS  ";Namelimit;
8240  LINPUT B$
8250  L1=LEN(B$)
8260  IF L1<=Namelimit THEN Subend
8270  Long=L1-Namelimit
8280  DISP
8290  DISP "Y AXIS NAME IS TO LONG BY ";Long
8300  Print
8310  PRINT "Y AXIS LIMITED TO   "&B$[1,Namelimit]
```

```
8320  Intprint
8330  GOTO 8210
8340 Subend: !
8350         SUBEND
8360  SUB Plotter(Pen,Vel)
8370  DISP "INPUT PEN AND PEN VELOCITY";
8380  Entry2(Q1,Q2,R5)
8390  ON R5 GOTO 8400,8370,8370
8400  Pen=Q1
8410  Vel=Q2
8420  PRINTER IS 705
8430  A$="VS"&VAL$(Vel)
8440  PRINT A$
8450  Intprint
8460  PEN Pen
8470  Extplot
8480  SUBEND
8490  SUB Typeplot(L5)
8500  LOOP
8510  ON KEY 1 LABEL "SELECT" GOTO Nokey
8520  ON KEY 2 LABEL "PLOT" GOTO Nokey
8530  ON KEY 3 LABEL "TYPE" GOTO Nokey
8540  ON KEY 4 LABEL "" GOTO Nokey
8550  ON KEY 5 LABEL "LIN_LIN (X,Y)" GOTO 8640
8560  ON KEY 6 LABEL "LIN_LOG (X,Y)" GOTO 8660
8570  ON KEY 7 LABEL "LOG_LIN (X,Y)" GOTO 8680
8580  ON KEY 8 LABEL "LOG_LOG (X,Y)" GOTO 8700
8590  END LOOP
8600 Nokey: !
8610        BEEP
8620        WAIT .5
8630        GOTO 8500
8640  L5=0
8650  GOTO 8720
8660  L5=1
8670  GOTO 8720
8680  L5=2
8690  GOTO 8720
8700  L5=3
8710  GOTO 8720
8720  OFF KEY
8730  SUBEND
8740  SUB Extprint
8750  PRINTER IS 701
8760  SUBEND
8770  SUB Extplot
8780  PLOTTER IS 705,"HPGL"
8790  SUBEND
8800  SUB Axesin(X1,X2,Y1,Y2,T1,T2,T3,T4,L5)
8810  ON L5+1 GOTO Lin_lin,Lin_log,Log_lin,Log_log
8820 Lin_lin: !
8830  DISP
8840  DISP "INPUT XMIN,XMAX,TIC MARK";
8850  Entry3(Q1,Q2,Q3,R5)
8860  ON R5 GOTO 8870,8840,8840
8870  X1=Q1
8880  X2=Q2
8890  T1=Q3
8900  DISP
8910  DISP "LABEL XAXIS EACH";
```

```
8920  Entry1(Q1,R5)
8930  ON R5 GOTO 8940,8910,8910
8940  T3=Q1
8950  DISP
8960  DISP "INPUT YMIN,YMAX,TIC MARK";
8970  Entry3(Q1,Q2,Q3,R5)
8980  ON R5 GOTO 8990,8960,8960
8990  Y1=Q1
9000  Y2=Q2
9010  T2=Q3
9020  DISP
9030  DISP "LABEL YAXIS EACH ";
9040  Entry1(Q1,R5)
9050  ON R5 GOTO 9060,9030,9030
9060  T4=Q1
9070  GOTO Subend
9080 Lin_log: !
9090  DISP
9100  DISP "INPUT XMIN,XMAX,TIC MARK";
9110  Entry3(Q1,Q2,Q3,R5)
9120  ON R5 GOTO 9130,9100,9100
9130  X1=Q1
9140  X2=Q2
9150  T1=Q3
9160  DISP
9170  DISP "LABEL XAXIS EACH";
9180  Entry1(Q1,R5)
9190  ON R5 GOTO 9200,9170,9170
9200  T3=Q1
9210  DISP
9220  DISP "INPUT YAXIS IN DECADES";
9230  Entry2(Q1,Q2,R5)
9240  ON R5 GOTO 9250,9220,9220
9250  Y1=INT(LGT(Q1))
9260  Y2=INT(LGT(Q2))
9270  T2=1
9280  T4=1
9290  GOTO Subend
9300 Log_lin: !
9310          DISP
9320          DISP "INPUT XMIN,XMAX IN DECADES";
9330          Entry2(Q1,Q2,R5)
9340          ON R5 GOTO 9350,9320,9320
9350          X1=INT(LGT(Q1))
9360          X2=INT(LGT(Q2))
9370          T1=1
9380          T3=1
9390          DISP
9400          DISP "INPUT YMIN,YMAX,TIC SPACING";
9410          Entry3(Q1,Q2,Q3,R5)
9420          ON R5 GOTO 9430,9400,9400
9430          Y1=Q1
9440          Y2=Q2
9450          T2=Q3
9460          DISP
9470          DISP "INPUT LABEL YAXIS EACH";
9480          Entry1(Q1,R5)
9490          ON R5 GOTO 9500,9470,9470
9500          T4=Q1
9510          GOTO Subend
```

```
9520 Log_log: !       !
9530          DISP
9540          DISP "INPUT XMIN,XMAX IN DECADES";
9550          Entry2(Q1,Q2,R5)
9560          ON R5 GOTO 9570,9540,9540
9570          X1=INT(LGT(Q1))
9580          X2=INT(LGT(Q2))
9590          T1=1
9600          T3=1
9610          DISP
9620          DISP "INPUT YMIN,YMAX IN DECADES";
9630          Entry2(Q1,Q2,R5)
9640          ON R5 GOTO 9650,9620,9620
9650          Y1=INT(LGT(Q1))
9660          Y2=INT(LGT(Q2))
9670          T2=1
9680          T4=1
9690          GOTO Subend
9700 Subend: !
9710  SUBEND
9720  SUB Yesno(R5)
9730  LOOP
9740  ON KEY 1 LABEL "YES" GOTO 9830
9750  ON KEY 2 LABEL "" GOTO 9730
9760  ON KEY 3 LABEL "" GOTO 9730
9770  ON KEY 5 LABEL "" GOTO 9730
9780  ON KEY 6 LABEL "" GOTO 9730
9790  ON KEY 7 LABEL "" GOTO 9730
9800  ON KEY 4 LABEL "NO" GOTO 9860
9810  ON KEY 8 LABEL "REPEAT ?" GOTO 9890
9820  END LOOP
9830  R5=1
9840  OFF KEY
9850   GOTO 9910
9860   R5=2
9870   OFF KEY
9880   GOTO 9910
9890   R5=3
9900   OFF KEY
9910   SUBEND
9920  SUB Entry1(Q1,R5)
9930  INPUT Q1
9940  BEEP 440,.5
9950   DISP
9960   DISP "IS INPUT  ";Q1;" CORRECT";
9970  Yesno(R5)
9980  ON R5 GOTO 10040,9990,9930
9990  BEEP
10000 DISP
10010  DISP "RE-ENTER DATA"
10020 WAIT 1.5
10030 BEEP
10040 SUBEND
10050 SUB Entry3(Q1,Q2,Q3,R5)
10060 INPUT Q1,Q2,Q3
10070 BEEP 440,.5
10080 DISP
10090  DISP "IS INPUTS ";Q1,Q2,Q3;" CORRECT";
10100 Yesno(R5)
10110 ON R5 GOTO 10170,10120,10060
```

```
10120 BEEP
10130 DISP
10140  DISP "RE-ENTER DATA"
10150 WAIT 1.5
10160 BEEP
10170 SUBEND
10180 SUB Plotgraph(X1,X2,X3,X4,Y1,Y2,Y3,Y4,T1,T2,T3,T4,A$,B$,L5,Open)
10190 IF Plotflag=0 THEN 10210
10200 Plotter(Pn,Vel)
10210 ON L5+1 GOTO Lin_lin,Lin_log,Log_lin,Log_log
10220 Lin_lin:!
10230         DEG
10240         LDIR 0
10250         CSIZE 3
10260         LORG 6
10270          J=1
10280          FOR Y=Y1 TO Y2 STEP (Y2-Y1)+(Open=1)*100
10290          MOVE X1,Y
10300          Major=T3
10310          FOR X=X1 TO X2 STEP T1
10320         PLOT X,Y,-1
10330         RPLOT 0,.01*J*(Y2-Y1)+.01*J*(Y2-Y1)*(Major=T3),-1
10340         RPLOT 0,0,-1
10350         IF Major=T3 THEN Major=0
10360         IF Major<>0 OR J=-1 THEN 10410
10370         PLOT X,Y-.01*(Y2-Y1),2
10380      !  IF ABS(X)<1.E-10 THEN X=0
10390         LABEL X*(ABS(X)>1.E-10)
10400         PLOT X,Y,1
10410         Major=Major+T1
10420         NEXT X
10430         PENUP
10440         J=-1
10450         NEXT Y
10460         MOVE X1+(X2-X1)/2,Y1-.1*(Y2-Y1)
10470         CSIZE 4
10480         LORG 4
10490         LABEL A$
10500         J=1
10510         LORG 8
10520         CSIZE 3
10530         FOR X=X1 TO X2 STEP (X2-X1)+(Open=1)*100
10540         MOVE X,Y1
10550         Major=T4
10560         FOR Y=Y1 TO Y2 STEP T2
10570         PLOT X,Y,-1
10580         RPLOT .01*J*(X2-X1)+.01*J*(X2-X1)*(Major=T4),0,-1
10590         RPLOT 0,0,-1
10600         IF Major=T4 THEN Major=0
10610         IF Major<>0 OR J=-1 THEN 10650
10620         PLOT X,Y,-2
10630         LABEL Y
10640         PLOT X,Y,1
10650         Major=Major+T2
10660         NEXT Y
10670         J=-1
10680         NEXT X
10690         MOVE X1-(X2-X1)*.1,(Y2+Y1)/2
10700         LDIR 90
10710         CSIZE 4,.6
```

```
10720          LORG 6
10730          LABEL B$
10740          GOTO Subend
10750 Lin_log:         !   lin X ,Y log
10760          DEG
10770          LDIR 0
10780          CSIZE 3
10790          LORG 6
10800          J=1
10810          FOR Y=Y1 TO Y2 STEP (Y2-Y1)+(Open=1)*100
10820          MOVE X1,Y
10830          Major=T3
10840          FOR X=X1 TO X2 STEP T1
10850          PLOT X,Y,-1
10860          RPLOT 0,.01*J*(Y2-Y1)+.01*J*(Y2-Y1)*(Major=T3),-1
10870          RPLOT 0,0,-1
10880          IF Major=T3 THEN Major=0
10890          IF Major<>0 OR J=-1 THEN 10930
10900          PLOT X,Y-.01*(Y2-Y1),2
10910          LABEL X
10920          PLOT X,Y,1
10930          Major=Major+T1
10940          NEXT X
10950          PENUP
10960          J=-1
10970          NEXT Y
10980          MOVE (X2+X1)/2,Y1-.1*(Y2-Y1)
10990          CSIZE 4,.6
11000          LORG 4
11010          LABEL A$
11020          J=1
11030          FOR X=X1 TO X2 STEP (X2-X1)+(Open=1)*100
11040          MOVE X,Y1
11050          FOR Y=Y1 TO Y2-1 STEP 1
11060          FOR I=1 TO 10 STEP 1
11070          PLOT X,Y+LGT(I),-1
11080          RPLOT J*(.02+.02*(I=10))*(X2-X1),0,-1
11090          RPLOT 0,0,-1
11100          NEXT I
11110          NEXT Y
11120          J=-1
11130          NEXT X
11140          CSIZE 2.5,.6
11150          LORG 6
11160          FOR I=Y1 TO Y2
11170          MOVE X1-.055*(X2-X1),I-.030*(Y2-Y1)
11180          LABEL "10"
11190          MOVE X1-.035*(X2-X1),I
11200          LORG 5
11210          LABEL INT(I)
11220          NEXT I
11230          MOVE X3,Y1+(Y2-Y1)/2
11240          LORG 6
11250          LDIR 90
11260          CSIZE 4
11270          LABEL B$
11280          GOTO Subend
11290 Log_lin:!                LGT X    LIN Y
11300         DEG
11310         LDIR 0
```

```
11320         J=1
11330         FOR Y=Y1 TO Y2 STEP (Y2-Y1)+(Open=1)*100
11340         MOVE X1,Y
11350         FOR X=X1 TO X2-1
11360         FOR I=1 TO 10
11370         PLOT X+LGT(I),Y,-1
11380         RPLOT 0,J*(.02+.02*(I=10))*(Y2-Y1),-1
11390         RPLOT 0,0,-1
11400         NEXT I
11410         NEXT X
11420         J=-1
11430         NEXT Y
11440         CSIZE 2.5,.6
11450         LORG 6
11460         FOR I=X1 TO X2
11470         MOVE I-.025*(X2-X1),Y1-.030*(Y2-Y1)
11480         LABEL "10"
11490         MOVE I,Y1-.01*(Y2-Y1)
11500         LABEL INT(I)
11510         NEXT I
11520         PENUP
11530         MOVE X1+(X2-X1)/2,Y1-.1*(Y2-Y1)
11540         LORG 4
11550         CSIZE 4
11560         LABEL A$
11570         J=1
11580         LORG 8
11590         CSIZE 3,.6
11600         FOR X=X1 TO X2 STEP (X2-X1)+(Open=1)*100
11610         MOVE X,Y1
11620         Major=T4
11630           FOR Y=Y1 TO Y2 STEP T2
11640           PLOT X,Y,-1
11650           RPLOT .01*J*(X2-X1)+.01*J*(X2-X1)*(Major=T4),0,-1
11660           RPLOT 0,0,-1
11670           IF Major=T4 THEN Major=0
11680           IF Major<>0 OR J=-1 THEN 11720
11690           PLOT X,Y,-2
11700           LABEL Y
11710           PLOT X,Y,1
11720           Major=Major+T2
11730           NEXT Y
11740           PENUP
11750           J=-1
11760           NEXT X
11770           MOVE X1-(X2-X1)*.1,(Y2+Y1)/2
11780           LDIR 90
11790           CSIZE 4,.6
11800           LORG 6
11810           LABEL B$
11820           LDIR 0
11830           GOTO Subend
11840 Log_log:!                 LGT X    LGT Y
11850         DEG
11860         LDIR 0
11870        J=1
11880        FOR Y=Y1 TO Y2 STEP (Y2-Y1)+(Open=1)*100
11890        MOVE X1,Y
11900        FOR X=X1 TO X2-1
11910        FOR I=1 TO 10
```

```
11920         PLOT X+LGT(I),Y
11930         RPLOT 0,J*(.02+.02*(I=10))*(Y2-Y1),-1
11940         RPLOT 0,0,-1
11950         NEXT I
11960         NEXT X
11970         J=-1
11980         NEXT Y
11990         CSIZE 2.5,.6
12000         LORG 6
12010         FOR I=X1 TO X2
12020         MOVE I-.025*(X2-X1),Y1-.030*(Y2-Y1)
12030         LABEL "10"
12040         MOVE I,Y1-.01*(Y2-Y1)
12050         LABEL INT(I)
12060         NEXT I
12070         PENUP
12080         MOVE X1+(X2-X1)/2,Y1-.1*(Y2-Y1)
12090         LORG 4
12100         CSIZE 4
12110         LABEL A$
12120           J=1
12130           FOR X=X1 TO X2 STEP (X2-X1)+(Open=1)*100
12140           MOVE X,Y1
12150           FOR Y=Y1 TO Y2-1 STEP 1
12160           FOR I=1 TO 10 STEP 1
12170           PLOT X,Y+LGT(I),-1
12180           RPLOT J*(.02+.02*(I=10))*(X2-X1),0,-1
12190           RPLOT 0,0,-1
12200           NEXT I
12210           NEXT Y
12220           J=-1
12230           NEXT X
12240           CSIZE 2.5,.6
12250           LORG 6
12260           FOR I=Y1 TO Y2
12270           MOVE X1-.055*(X2-X1),I-.030*(Y2-Y1)
12280           LABEL "10"
12290           MOVE X1-.035*(X2-X1),I
12300           LORG 5
12310           LABEL INT(I)
12320           NEXT I
12330           MOVE X3,Y1+(Y2-Y1)/2
12340           LORG 6
12350           LDIR 90
12360           CSIZE 4
12370           LABEL B$
12380 Subend:       !
12390               IF Plotflag=1 THEN 12460
12400               DISP
12410               DISP "PUT THIS ON THE PLOTTER ";
12420               Yesno(R5)
12430               ON R5 GOTO 12440,12460,12390
12440               Plotflag=1
12450               GOTO 10180
12460               PEN 0
12470               Intplot
12480               PEN 1
12490               SUBEND
12500 SUB Linetype(Linetype)
12510 DISP
```

```
12520 DISP " INPUT LINE TYPE (1,10)  ";
12530 INPUT Linetype
12540 IF Linetype<1 OR Linetype>10 THEN 12520
12550 LINE TYPE Linetype,9
12560 SUBEND
12570 SUB Open_plot(Open)
12580 LOOP
12590 ON KEY 1 LABEL "OPEN     PLOT" GOTO 12680
12600 ON KEY 2 LABEL "" GOTO 12590
12610 ON KEY 3 LABEL "" GOTO 12590
12620 ON KEY 4 LABEL "CLOSED   PLOT" GOTO 12710
12630 ON KEY 5 LABEL "" GOTO 12590
12640 ON KEY 6 LABEL "" GOTO 12590
12650 ON KEY 7 LABEL "" GOTO 12590
12660 ON KEY 8 LABEL "" GOTO 12590
12670 END LOOP
12680 OFF KEY
12690 Open=1
12700 GOTO Subend
12710 OFF KEY
12720 Open=0
12730 Subend:!
12740 SUBEND
12750     SUB Symbol(Symbol)
12760 Symbol:  REM SELECT SYMBOL
12770          LOOP
12780 ON KEY 1 LABEL "STAR" GOTO 12890
12790 ON KEY 2 LABEL "TRIANGLE" GOTO 12910
12800 ON KEY 3 LABEL "DIMOUND" GOTO 12930
12810 ON KEY 4 LABEL "HOUSE" GOTO 12950
12820 ON KEY 5 LABEL "SQUARE" GOTO 12970
12830 !ON KEY 5 LABEL "   X  " GOTO 12780
12840 !ON KEY 6 LABEL "   +  " GOTO 12800
12850 ON KEY 6 LABEL "SIDE TRIANGLE" GOTO 13030
12860 ON KEY 7 LABEL "   *   " GOTO 13050
12870 ON KEY 8 LABEL "CIRCLE" GOTO 13070
12880 END LOOP
12890 Symbol=1
12900 GOTO Subend
12910 Symbol=2
12920 GOTO Subend
12930 Symbol=3
12940 GOTO Subend
12950 Symbol=4
12960 GOTO Subend
12970 Symbol=5
12980 GOTO Subend
12990 Symbol=6
13000 GOTO Subend
13010 Symbol=7
13020 GOTO Subend
13030 Symbol=8
13040 GOTO Subend
13050 Symbol=9
13060 GOTO Subend
13070 Symbol=10
13080 OFF KEY
13090 Subend:!
13100     SUBEND
13110          SUB Plot_symbol(X5,Y5,Symbol,H)
```

```
13120 ON Symbol GOTO Symbol1,Symbol2,Symbol3,Symbol4,Symbol5,Symbol6,Symbol7,Sym
bol8,Symbol9,Symbol10
13130       !STAR SYMBOL
13140 Symbol1:!
13150 IPLOT 0,.01*Y5,-2
13160 IPLOT .006*X5/RATIO,-.018*Y5,-1
13170 IPLOT -.0155*X5/RATIO,.011*Y5,-1
13180 IPLOT .019*X5/RATIO,0,-1
13190 IPLOT -.0155*X5/RATIO,-.011*Y5,-1
13200 IPLOT .006*X5/RATIO,.018*Y5,-1
13210 IPLOT 0,-.01*Y5,-2
13220 IPLOT 0,0,H
13230 GOTO Subend
13240 Symbol2:!
13250 !TRIANGLE SYMBOL
13260 IPLOT 0,.01*Y5,-2
13270 IPLOT .01*X5/RATIO,-.02*Y5,-1
13280 IPLOT -.02*X5/RATIO,0,-1
13290 IPLOT .01*X5/RATIO,.02*Y5,-1
13300 IPLOT 0,-.01*Y5,-2
13310 IPLOT 0,0,H
13320 GOTO Subend
13330 PENUP
13340 Symbol3:!
13350 !DIMAOND
13360 IPLOT 0,.01*Y5,-2
13370 IPLOT .01*X5/RATIO,-.01*Y5,-1
13380 IPLOT -.01*X5/RATIO,-.01*Y5,-1
13390  IPLOT -.01*X5/RATIO,.01*Y5,-1
13400  IPLOT .01*X5/RATIO,.01*Y5,-1
13410  IPLOT 0,-.01*Y5,-2
13420  IPLOT 0,0,H
13430  GOTO Subend
13440  PENUP
13450 Symbol4: !
13460   !HOUSE
13470  IPLOT 0,.01*Y5,-2
13480  IPLOT .01*X5/RATIO,-.01*Y5,-1
13490  IPLOT 0,-.01*Y5,-1
13500  IPLOT -.02*X5/RATIO,0,-1
13510  IPLOT 0,.01*Y5,-1
13520  IPLOT .01*X5/RATIO,.01*Y5,-1
13530  IPLOT 0,-.01*Y5,-2
13540  IPLOT 0,0,H
13550  GOTO Subend
13560  PENUP
13570 Symbol5: !
13580         !SQUARE SYMBOL
13590  IPLOT -.01*X5/RATIO,.01*Y5,-2
13600  IPLOT .02*X5/RATIO,0,-1
13610  IPLOT 0,-.02*Y5,-1
13620  IPLOT -.02*X5/RATIO,0,-1
13630  IPLOT 0,.02*Y5,-1
13640  IPLOT .01*X5/RATIO,-.01*Y5,-2
13650  IPLOT 0,0,H
13660  GOTO Subend
13670  PENUP
13680 Symbol6: !
13690         ! X SYMBOL
13700  IPLOT -.01*X5/RATIO,.01*Y5,-2
```

```
13710  IPLOT .02*X5/RATIO,-.02*Y5,-1
13720  IPLOT 0,.02*Y5,-2
13730  IPLOT -.02*X5/RATIO,-.02*Y5,-1
13740  IPLOT .01*X5/RATIO,.01*Y5,-2
13750  IPLOT 0,0,H
13760  GOTO Subend
13770  PENUP
13780 Symbol7: !
13790          ! + SYMBOL
13800  IPLOT .01*X5/RATIO,0,-2
13810  IPLOT -.02*X5/RATIO,0,-1
13820  IPLOT .01*X5/RATIO,.01*Y5,-2
13830  IPLOT 0,-.02*Y5,-1
13840  IPLOT 0,.01*Y5,-2
13850  IPLOT 0,0,H
13860   GOTO Subend
13870   PENUP
13880 Symbol8:  !
13890            ! TRINAGLE ON SIDE SYMBOL
13900   IPLOT -.01*X5/RATIO,.01*Y5,-2
13910   IPLOT 0,-.02*Y5,-1
13920   IPLOT .02*X5/RATIO,0,-1
13930   IPLOT -.02*X5/RATIO,.02*Y5,-1
13940   IPLOT .01*X5/RATIO,-.01*Y5,-2
13950   IPLOT 0,0,H
13960   GOTO Subend
13970 Symbol9:  !
13980            ! * SYMBOL
13990   IPLOT 0,.01*Y5,-2
14000   IPLOT 0,-.02*Y5,-1
14010   IPLOT -.01*X5/RATIO,0,-2
14020   IPLOT .02*X5/RATIO,.02*Y5,-1
14030   IPLOT -.02*X5/RATIO,0,-2
14040   IPLOT .02*X5/RATIO,-.02*Y5,-1
14050   IPLOT -.01*X5/RATIO,.01*Y5,-1
14060   IPLOT 0,0,H
14070   GOTO Subend
14080 Symbol10:  !
14090            ! CIRCLE
14100   DEG
14110   FOR Deg=0 TO 360 STEP 5
14120   RPLOT .01*X5*SIN(Deg)/RATIO,.01*Y5*COS(Deg),1
14130   NEXT Deg
14140   RPLOT 0,0,H
14150   GOTO Subend
14160 Subend:  !
14170          SUBEND
14180  SUB Aclear  ! SUB TO Clear Screen  OF PRINT
14190  OUTPUT 2 USING "#,B";255,75  ! USE Aclear AS A SINGLE STATEMENT
14200  SUBEND
14210 SUB Plotequation(Xmin,Xmax,Deltax)
14220 DIM Eq$[80]
14230 LOOP
14240 ON KEY 1 LABEL "SCREEN" GOTO 14290
14250 ON KEY 2 LABEL "" GOTO 14230
14260 ON KEY 3 LABEL "" GOTO 14230
14270 ON KEY 4 LABEL "PLOTTER" GOTO 14330
14280 END LOOP
14290 OFF KEY
14300 Plotflag=1
```

```
14310 Intplot
14320 GOTO 14350
14330 OFF KEY
14340 Plotter(Pen,Vel)
14350 DISP "SELECT LINE TYPE FOR EQUATION";
14360 Linetype(Linetype)
14370 LOOP
14380 ON KEY 1 LABEL "PRINT INT" GOTO 14430
14390 ON KEY 2 LABEL "NO PRINT" GOTO 14460
14400 ON KEY 3 LABEL "" GOTO 14370
14410 ON KEY 4 LABEL "PRINT EXT" GOTO 14490
14420 END LOOP
14430 OFF KEY
14440 Intprint
14450 GOTO 14510
14460 OFF KEY
14470 Noprint=1
14480 GOTO 14510
14490 OFF KEY
14500 Extprint
14510 DISP
14520 DISP "INPUT FILE FOR EQUATION";
14530 INPUT File$
14540 DISP "INPUT XMIN,XMAX,DELTAX";
14550 INPUT Xmin,Xmax,Deltax
14560 LOADSUB ALL FROM File$
14570 Equation(Xmin,Ymin,Eq$)
14580 MOVE Xmin,Y          ! START OF PLOT LOCATION
14590 DEG                  !  SELECT DEG MODE
14600 FOR X=Xmin TO Xmax STEP Deltax
14610 Equation(X,Y,Eq$)
14620 IF Noprint=1 THEN 14640
14630 PRINT X,Y
14640 DRAW X,Y
14650 NEXT X
14660 Intprint
14670 Intplot
14680 LINE TYPE 1
14690 DELSUB Equation
14700 SUBEND
14710 SUB Compare(D(*),Eq$,Std_dev)
14720 OPTION BASE 1
14730 MASS STORAGE IS Data$          !MSI OF DATA STORAGE
14740 ON ERROR GOTO Error
14750 Datafile:!
14760 DISP
14770 DISP "INPUT DATA FILE NAME";
14780 INPUT File$
14790 DISP
14800 DISP "INPUT REC/FILE FOR  ";File$;
14810 INPUT Npts
14820 REDIM Dat(Npts,2)
14830 ASSIGN @Ab TO File$
14840 ENTER @Ab;Dat(*)
14850 MASS STORAGE IS Program$        ! MSI OF PROGRAM FILE
14860 Equation:!
14870         Eq=1
14880         ON ERROR GOTO Error
14890 DISP
14900 DISP " INPUT FILE NAME FOR EQUATION";
```

```
14910 INPUT File$
14920 LOADSUB ALL FROM File$
14930 FOR I=1 TO Npts
14940 X=Dat(I,1)
14950 Equation(X,Y,Eq$)
14960 Sumdiff=Sumdiff+(Dat(I,2)-Y)
14970 Sumsq=Sumsq+(Dat(I,2)-Y)*(Dat(I,2)-Y)
14980 NEXT I
14990 Std_dev=((Sumsq-(Sumdiff*Sumdiff)/Npts)/(Npts-1))^.5
15000 LOOP
15010 ON KEY 1 LABEL "PRINT    SCREEN" GOTO 15090
15020 ON KEY 2 LABEL "" GOTO 15000
15030 ON KEY 3 LABEL "" GOTO 15000
15040 ON KEY 4 LABEL "EXTERNAL PRINT" GOTO 15060
15050 END LOOP
15060 OFF KEY
15070 Extprint
15080 GOTO 15110
15090 OFF KEY
15100 Intprint
15110 PRINT "FOR EQUATION ";Eq$
15120 PRINT USING "30A,MD.3DE";"THE STD DEV OF (Y-CAL Y)  IS ";Std_dev
15130 PRINT
15140 PRINT "          DATA(X)         DATA(Y)          CAL Y          Y-CAL Y
  SIGMA"
15150 FOR I=1 TO Npts
15160 X=Dat(I,1)
15170 Equation(X,Y,Eq$)
15180 PRINT USING 15190;I,Dat(I,1),Dat(I,2),Y,Dat(I,2)-Y,(Dat(I,2)-Y)/Std_dev
15190 IMAGE DDDD,5X,MD.3DE,5X,MD.3DE,5X,MD.3DE,5X,MD.3DE,5X,DD.DD
15200 NEXT I
15210 PRINT USING "//"
15220 DELSUB Equation
15230 GOTO Subend
15240 Error:!
15250       CAT
15260       PRINT "ERROR DETECTED "
15270       PRINT "CHECK  FILE NAME AND/OR REC/FILE "
15280       PRINT "CONTINUE WHEN READY"
15290       PAUSE
15300       OFF ERROR
15310       IF Eq=1 THEN 15330
15320       GOTO Datafile
15330       GOTO Equation
15340 Subend:     !
15350             Intprint
15360 SUBEND
15370 SUB Datacheck(Dat(*),Npts)
15380 OPTION BASE 1
15390 Printdata:!
15400 FOR I=1 TO Npts
15410 PRINT I,Dat(I,1),Dat(I,2)
15420 NEXT I
15430 PRINT USING "//"
15440 Datamod:!
15450 LOOP
15460 ON KEY 1 LABEL "ADD DATA" GOTO 15650
15470 ON KEY 2 LABEL "SORT <X" GOTO 16020
15480 ON KEY 4 LABEL "MOD DATA" GOTO 15720
15490 ON KEY 5 LABEL "SORT <Y" GOTO 16060
```

```
15500 ON KEY 7 LABEL "REMOVE DATA" GOTO 15750
15510 ON KEY 3 LABEL "SORT >X" GOTO 15940
15520 ON KEY 9 LABEL "INT PRINT" GOTO Intprint
15530 ON KEY 6 LABEL "SORT >Y" GOTO 15980
15540 ON KEY 10 LABEL "EXT PRINT" GOTO Extprint
15550 ON KEY 8 LABEL "DATA OK,(EXIT)" GOTO Subend
15560 ON KEY 15 LABEL "KBD1" GOTO Control
15570 !ON KEY 7 LABEL "KBD2" GOTO Control
15580 END LOOP
15590 Control:!
15600         IF Control<1 THEN Control=1
15610         Control=Control+1
15620         IF Control>=3 THEN Control=1
15630         CONTROL KBD,2;Control
15640         GOTO 15450
15650 OFF KEY
15660 Npts=Npts+1
15670 REDIM Dat(Npts,2)
15680 DISP
15690 DISP "INPUT X,Y FOR DATA POINT ";Npts;
15700 INPUT Dat(Npts,1),Dat(Npts,2)
15710 GOTO Printdata
15720 OFF KEY
15730       Mod_data(Dat(*),Npts)
15740 GOTO Printdata
15750 OFF KEY
15760 DISP
15770 DISP "INPUT POINTS TO BE DELETED P1,P1";
15780 INPUT Pt1,Pt2
15790 IF Pt2>=Pt1 THEN 15840
15800 P1=Pt2
15810 P2=Pt1
15820 Pt1=P1
15830 Pt2=P2
15840 Cc=0
15850 FOR I=1 TO Npts
15860 IF I>Pt1-1 AND I<Pt2+1 THEN 15900
15870 Cc=Cc+1
15880 Dat(Cc,1)=Dat(I,1)
15890 Dat(Cc,2)=Dat(I,2)
15900 NEXT I
15910 Npts=Npts-(Pt2-Pt1+1)
15920 REDIM Dat(Npts,2)
15930 GOTO Printdata
15940 OFF KEY
15950 REDIM Dat(Npts,2)
15960 MAT SORT Dat(*,1)
15970 GOTO Printdata
15980 OFF KEY
15990 REDIM Dat(Npts,2)
16000 MAT SORT Dat(*,2)
16010 GOTO Printdata
16020 OFF KEY
16030 REDIM Dat(Npts,2)
16040 MAT SORT Dat(*,1) DES
16050 GOTO Printdata
16060 OFF KEY
16070 REDIM Dat(Npts,2)
16080 MAT SORT Dat(*,2) DES
16090 GOTO Printdata
```

```
16100 Intprint:!
16110          BEEP
16120 Intprint
16130 PRINT "PRINTER IS INTERNAL"
16140 BEEP
16150 GOTO 15450
16160 Extprint:!
16170          BEEP
16180 Extprint
16190 PRINT "PRINTER IS EXTERNAL"
16200 BEEP
16210 GOTO 15450
16220 Subend:!
16230 SUBEND
16240  SUB Mod_data(Dat(*),Npts)
16250  OPTION BASE 1
16260 Datamod:!
16270         Aclear
16280 PRINT "                    SELECT DATA MOD FORM"
16290 PRINT
16300 PRINT "NOTE ;  DROUND ROUNDS OFF TO SPECIFIED # OF SIGNIFICANT DIGITS"
16310 PRINT "        PROUND ROUNDS OFF TO SPECIFIED POWER OF TEN    "
16320 PRINT "        FORMS 1,15 APPLY TO ALL POINTS "
16330 PRINT
16340 PRINT "                0. EXIT"
16350! PRINT
16360 PRINT "1  X=A*X^B+C             8  Y=A*Y^B+C"
16370 PRINT "2  X=A*LOG(BX)+C         9  Y=A*LOG(BX)+C"
16380 PRINT "3  X=A*LN(BX)+C         10  Y=A*LN(BX)+C "
16390 PRINT "4  X=A*EXP(BX)+C        11  Y=A*EXP(BX)+C"
16400 PRINT "5  X=A*10^(BX)+C        12  Y=A*10^(BY)+C"
16410 PRINT "6  X=DROUND(X,A)        13  Y=DROUND(Y,A)  "
16420 PRINT "7  X=PROUND(X,A)        14  Y=PROUND(Y,A)  "
16430 PRINT "    15  SWAP X AND Y VALUES          "
16440 PRINT "    16  USER DEFINED MOD OF DATA     "
16450 PRINT "    17  MOD X,Y OF A SELECTED POINTS"
16460 PRINT
16470 BEEP
16480 DISP "INPUT FORM ";
16490!PAUSE
16500 INPUT Form
16510 IF Form=0 THEN Subend
16520 IF Form>5 AND Form<8 THEN 16600
16530 IF Form>12 THEN 16580
16540 DISP
16550 DISP "INPUT A,B,C";
16560 INPUT A,B,C
16570 GOTO Moddata
16580 IF Form>14 THEN 16630
16590 DISP
16600 DISP "INPUT A";
16610 INPUT A
16620 GOTO Moddata
16630 IF Form>15 THEN GOTO 16720
16640 ! SWAP X&Y
16650 FOR I=1 TO Npts
16660 Tempx=Dat(I,2)
16670 Tempy=Dat(I,1)
16680 Dat(I,1)=Tempx
16690 Dat(I,2)=Tempy
```

```
16700 NEXT I
16710 GOTO Datacheck
16720 IF Form=16 THEN GOTO Userdefined
16730 DISP
16740 DISP "INPUT POINT #, New X, New Y";
16750 INPUT Pt,X,Y
16760 Dat(Pt,1)=X
16770 Dat(Pt,2)=Y
16780 DISP
16790 DISP "ANY MORE";
16800 Yesno(R5)
16810 ON R5 GOTO 16740,16820,16780
16820 GOTO Datacheck
16830 Moddata:!
16840          Negflagx=0
16850          Negflagy=0
16860         FOR I=1 TO Npts
16870          ON Form GOTO Linx,Logx,Lnx,Expx,Tenx,Drounx,Prounx,Liny,Logy,Lny,E
xpy,Teny,Drouny,Prouny
16880 Next:          !
16890          NEXT I
16900          GOTO Datacheck
16910 Linx:          !
16920                FOR J=1 TO B-1
16930                Dat(I,1)=Dat(I,1)*Dat(I,1)
16940                NEXT J
16950                Dat(I,1)=A*Dat(I,1)+C
16960                GOTO Next
16970 Logx:               !
16980                     IF Negflagx=1 THEN Next
16990                     IF I>1 THEN 17020
17000                 Negcheckx(Dat(*),Npts,Negflagx)
17010                 IF Negflagx=1 THEN Next
17020               Dat(I,1)=A*LGT(B*Dat(I,1))+C
17030               GOTO Next
17040 Lnx:              !
17050                   IF Negflagx=1 THEN Next
17060                   IF I>1 THEN 17090
17070                   Negcheckx(Dat(*),Npts,Negflagx)
17080                   IF Negflagx=1 THEN Next
17090                Dat(I,1)=A*LOG(B*Dat(I,1))+C
17100                GOTO Next
17110 Expx:               !
17120              Dat(I,1)=A*EXP(B*Dat(I,1))+C
17130               GOTO Next
17140 Tenx:              !
17150               Dat(I,1)=A*10^(B*Dat(I,1))+C
17160            GOTO Next
17170 Drounx:           !
17180                  Dat(I,1)=DROUND(Dat(I,1),A)
17190              GOTO Next
17200 Prounx:            !
17210               Dat(I,1)=PROUND(Dat(I,1),A)
17220                GOTO Next
17230 Liny:              !
17240                    FOR J=1 TO B-1
17250                    Dat(J,2)=Dat(J,2)*Dat(J,2)
17260                    NEXT J
17270              Dat(I,2)=A*Dat(I,2)+C
17280                GOTO Next
```

```
17290 Logy:             !
17300                   IF Negflagy=1 THEN Next
17310                   IF I>1 THEN 17340
17320                   Negchecky(Dat(*),Npts,Negflagy)
17330                   IF Negflagy=1 THEN Next
17340            Dat(I,2)=A*LGT(B*Dat(I,2))+C
17350             GOTO Next
17360 Lny:             !
17370                  IF Negflagy=1 THEN Next
17380                  IF I>1 THEN 17410
17390                  Negchecky(Dat(*),Npts,Negflagy)
17400                  IF Negflagy=1 THEN Next
17410            Dat(I,2)=A*LOG(B*Dat(I,2))+C
17420             GOTO Next
17430 Expy:            !
17440            Dat(I,2)=A*EXP(B*Dat(I,2))+C
17450              GOTO Next
17460 Teny:            !
17470             Dat(I,2)=A*10^(B*Dat(I,2))+C
17480             GOTO Next
17490 Drouny:           !
17500             Dat(I,2)=DROUND(Dat(I,2),A)
17510             GOTO Next
17520 Prouny:           !
17530             Dat(I,2)=PROUND(Dat(I,2),A)
17540             GOTO Next
17550 Userdefined:   !
17560                FOR I=1 TO Npts
17570                !   Y = FUNCTION OF X OR Y
17580                !   X= FUNCTION  OF X OR Y
17590                NEXT I
17600                GOTO Datacheck
17610 Datacheck:!
17620           FOR I=1 TO Npts
17630           PRINT I,Dat(I,1),Dat(I,2)
17640           NEXT I
17650           DISP
17660           DISP "DATA OK  ?  ";
17670           Yesno(R5)
17680           ON R5 GOTO Subend,Datamod,17650
17690 Subend:           !
17700  SUBEND
17710 SUB Negcheckx(Dat(*),Npts,Negflagx)
17720 OPTION BASE 1
17730 Negflagx=0
17740 FOR J=1 TO Npts
17750 IF Dat(J,1)<=0 THEN 17780
17760 NEXT J
17770 GOTO 17800
17780 Negflagx=1
17790 PRINT "CAN NOT TAKE LOG OF NUMBER <=0"
17800 SUBEND
17810 SUB Negchecky(Dat(*),Npts,Negflagy)
17820 OPTION BASE 1
17830 Negflagy=0
17840 FOR J=1 TO Npts
17850 IF Dat(J,2)<=0 THEN 17880
17860 NEXT J
17870 GOTO 17900
17880 Negflagy=1
```

```
17890 PRINT "CAN NOT TAKE LOG OF NUMBER <=0"
17900 SUBEND
17910 SUB Detzero(E(*),D1,L5,Yvalue)
17920 DISP
17930 DISP " INPUT MIN X ,MAX X, STEP SIZE FOR INITIAL SEARCH";
17940 INPUT Minx,Maxx,Stepsize
17950 Co=0
17960 FOR X=Minx TO Maxx STEP Stepsize
17970 Yvalue=0
17980  Yvalue=E(D1+1)
17990  FOR J=D1 TO 1 STEP -1
18000  Yvalue=Yvalue*X+E(J)
18010  NEXT J
18020  Yvalue=Yvalue*(L5=0 OR L5=2)+10^Y*(L5=1 OR L5=3)
18030  IF Yvalue>0 THEN Minx=X-Stepsize
18040  IF Yvalue>0 THEN Maxx=X+Stepsize+.01*Stepsize
18050  IF Yvalue>0 THEN Stepsize=Stepsize/10
18060  IF Yvalue>0 THEN Co=Co+1
18070  IF Yvalue>0 AND Co<7 THEN GOTO 17960
18080  IF Yvalue>0 AND Co=7 THEN PRINT "VALUE OF POLY AT ";X;"  EQUAL ";Yvalue
18090  IF Yvalue<0 AND Co=7 THEN PRINT "DID NOT FIND A ZERO FOR POLY  "
18100  NEXT X
18110 SUBEND
18120     SUB Dataselect(Dfile$)
18130 OPTION BASE 1
18140 DIM Cat$(144)[80]
18150 DIM C$(1)[80]
18160 CAT TO Cat$(*)      ! CAT OF DISC TO CAT$
18170 Cp=0
18180   FOR I=5 TO 144
18190   IF Cat$(I)="" THEN 18280
18200   Cp=Cp+1
18210   IF I>4 THEN 18240
18220   PRINT USING "DDD,3A,22A";I," ",Cat$(I)[1,22]
18230   GOTO 18270
18240   IF Cat$(I)[32,36]="BDAT " THEN 18260
18250   GOTO 18270
18260   PRINT USING "DDD,3A,21A,23A";I," ",Cat$(I)[1,21],Cat$(I)[32,55]
18270   NEXT I
18280   PRINT "ENTER 0 TO EXIT PROGRAM"
18290 DISP "SELECT DATA    FILE BY NUMBER     ";
18300 INPUT N
18310 IF N=0 THEN 18330
18320 Dfile$=Cat$(N)[1,10]
18330     SUBEND
18340    SUB Config36(Program$,Data$)
18350    DISP
18360    CONTROL KBD,2;1
18370    DISP "SELECT OPTION";
18380    LOOP
18390    ON KEY 0 LABEL "PROGRAM" GOTO 18370
18400    ON KEY 1 LABEL "INT,0" GOTO Pinternal0
18410    ON KEY 2 LABEL "INT,1" GOTO Pinternal1
18420    ON KEY 3 LABEL "700,0" GOTO P7000
18430    ON KEY 4 LABEL "700,1" GOTO P7001
18440    ON KEY 5 LABEL "DATA " GOTO 18380
18450    ON KEY 6 LABEL "INT,0" GOTO Dinternal0
18460    ON KEY 7 LABEL "INT,1" GOTO Dinternal1
18470    ON KEY 8 LABEL "700,0" GOTO D7000
18480    ON KEY 9 LABEL "700,1" GOTO D7001
```

```
18490    END LOOP
18500 Pinternal0:    !
18510                Program$=":INTERNAL4,0"
18520                GOTO Subend
18530 Pinternal1:                !
18540               Program$=":INTERNAL4,1"
18550               GOTO Subend
18560 P7000:       Program$=":,700,0"
18570     GOTO Subend
18580 P7001:       !
18590             Program$=":,700,1"
18600             GOTO Subend
18610 Dinternal0:  !
18620              Data$=":INTERNAL4,0"
18630              GOTO Subend
18640 Dinternal1:!
18650             Data$=":INTERNAL,4,1"
18660             GOTO Subend
18670 D7000:       Data$=":,700,0"
18680             GOTO Subend
18690 D7001:!
18700           Data$=":,700,1"
18710           GOTO Subend
18720 Subend:!
18730         BEEP
18740         Flag=Flag+1
18750         IF Flag=2 THEN 18790
18760         DISP
18770         DISP "SELECT NEXT OPTION";
18780         IF Flag<=1 THEN 18380
18790         PRINT "PROGRAM MSI IS ";Program$
18800         PRINT "DATA MSI IS ";Data$
18810         SUBEND
18820     SUB Config320(Program$,Data$)
18830     CONTROL KBD,2;1
18840 DISP
18850 DISP "SELECT OPTION";
18860 LOOP
18870 ON KEY 1 LABEL "PROGRAM" GOTO 18840
18880 ON KEY 2 LABEL "" GOTO 18860
18890 ON KEY 3 LABEL "" GOTO 18860
18900 ON KEY 4 LABEL "" GOTO 18860
18910 ON KEY 5 LABEL "704,0" GOTO Pinternal0
18920 ON KEY 6 LABEL "704,1" GOTO Pinternal1
18930 ON KEY 7 LABEL "700,0" GOTO Php0
18940 ON KEY 8 LABEL "700,1" GOTO Php1
18950 ON KEY 9 LABEL "DATA" GOTO 18840
18960 ON KEY 10 LABEL "" GOTO 18860
18970 ON KEY 11 LABEL "" GOTO 18860
18980 ON KEY 12 LABEL "" GOTO 18860
18990 ON KEY 13 LABEL "704,0" GOTO Dinternal0
19000 ON KEY 14 LABEL "704,1" GOTO Dinternal1
19010 ON KEY 15 LABEL "700,0" GOTO Dhp0
19020 ON KEY 16 LABEL "700,1" GOTO Dhp1
19030 END LOOP
19040 Pinternal0:!
19050           Program$=":,704,0"
19060           GOTO End
19070 Pinternal1:!
19080           Program$=":,704,1"
```

```
19090             GOTO End
19100 Php1:        !
19110             Program$=":,700,1"
19120             GOTO End
19130 Php0:        !
19140             Program$=":,700,0"
19150             GOTO End
19160 Dinternal0:!
19170             Data$=":,704,0"
19180             GOTO End
19190 Dinternal1:!
19200             Data$=":,704,1"
19210             GOTO End
19220 Dhp1:        !
19230             Data$=":,700,1"
19240             GOTO End
19250 Dhp0:        !
19260             Data$=":,700,0"
19270             GOTO End
19280 End:!
19290     BEEP
19300     Flag=Flag+1
19310     IF Flag=2 THEN 19360
19320     DISP
19330     DISP "SELECT NEXT OPTION";
19340     CONTROL KBD,2;2
19350     IF Flag<=1 THEN 18860
19360     DISP
19370     CONTROL KBD,2;1
19380     SUBEND
```

ATTACHMENT D - SUMS SOFTWARE LISTING

(6) SUMSDIS90:

```
10 !   RE-STORE   "SUMSDISP90"
20     OPTION BASE 1
30     DIM Me(2,14)    ! MATRIX FOR STORAGE OF STEP AND AMU DATA
31 ! REVISION    5/15/90      RJD
40 !   CONFIG36(PROGRAM$,DATA$)
50     Config320(Program$,Data$)
60     !READ DATA FROM HARD DISK FILE
70     INTEGER Mass_scale(12480)
80     INTEGER Pic1(12480),Pic2(12480),Pic3(12480),Pic4(12480),Pic5(12480)
90     INTEGER Pic6(12480),Pic7(12480),Pic8(12480),Pic9(12480),Pic10(12480)
100    INTEGER Pic11(12480),Pic12(12480),Pic13(12480),Pic14(12480),Pic15(12480)
110    INTEGER Pic16(12480),Pic17(12480),Pic18(12480),Pic19(12480),Pic20(12480)
120    INTEGER Pic21(12480),Pic22(12480),Pic23(12480),Pic24(12480),Pic25(12480)
130    INTEGER Pic26(12480),Pic27(12480),Pic28(12480),Pic29(12480),Pic30(12480)
140    INTEGER Pic31(12480),Pic32(12480),Pic33(12480),Pic34(12480),Pic35(12480)
150    INTEGER Pic36(12480),Pic37(12480),Pic38(12480),Pic39(12480),Pic40(12480)
160    INTEGER Pic41(12480),Pic42(12480),Pic43(12480),Pic44(12480),Pic45(12480)
170    INTEGER Pic46(12480),Pic47(12480),Pic48(12480),Pic49(12480),Pic50(12480)
180    INTEGER Pic51(12480),Pic52(12480),Pic53(12480),Pic54(12480),Pic55(12480)
190    INTEGER Pic56(12480),Pic57(12480),Pic58(12480),Pic59(12480),Pic60(12480)
200    INTEGER Pic61(12480),Pic62(12480),Pic63(12480),Pic64(12480),Pic65(12480)
210    INTEGER Pic66(12480),Pic67(12480),Pic68(12480),Pic69(12480),Pic70(12480)
220    INTEGER Pic71(12480),Pic72(12480),Pic73(12480),Pic74(12480),Pic75(12480)
230    INTEGER Pic76(12480),Pic77(12480),Pic78(12480),Pic79(12480),Pic80(12480)
240    INTEGER Pic81(12480),Pic82(12480),Pic83(12480),Pic84(12480),Pic85(12480)
250    INTEGER Pic86(12480),Pic87(12480),Pic88(12480),Pic89(12480),Pic90(12480)
260    INTEGER Pic91(12480),Pic92(12480),Pic93(12480),Pic94(12480),Pic95(12480)
270    INTEGER Pic96(12480),Pic97(12480),Pic98(12480),Pic99(12480),Pic100(12480)
280 INTEGER Pic101(12480),Pic102(12480),Pic103(12480),Pic104(12480),Pic105(12480
)
290 INTEGER Pic106(12480),Pic107(12480),Pic108(12480),Pic109(12480),Pic110(12480
)
300 INTEGER Pic111(12480),Pic112(12480),Pic113(12480),Pic114(12480),Pic115(12480
)
310 INTEGER Pic116(12480),Pic117(12480),Pic118(12480),Pic119(12480),Pic120(12480
)
320 INTEGER Pic121(12480),Pic122(12480),Pic123(12480),Pic124(12480),Pic125(12480
)
330 INTEGER Pic126(12480),Pic127(12480),Pic128(12480),Pic129(12480),Pic130(12480
)
340 INTEGER Pic131(12480),Pic132(12480),Pic133(12480),Pic134(12480),Pic135(12480
)
350 INTEGER Pic136(12480),Pic137(12480),Pic138(12480),Pic139(12480),Pic140(12480
)
360 INTEGER Pic141(12480),Pic142(12480),Pic143(12480),Pic144(12480),Pic145(12480
)
370    INTEGER Index,Aa,Bb,Maxstep
380    Maxstep=280  !        360
390    DIM Sums(380),Sumsbkg1(380),Sumsbkg2(380),Sumsbkg3(380),Sumsbkg4(380)
!SUMS(ONE SCAN)
400    MASS STORAGE IS Data$
410    CAT
420    DISP "INPUT FILE NAME";
430    INPUT Dfile$
440    GOTO Bypassbkg
450    ASSIGN @Ab TO Dfile$
460    ENTER @Ab;Sums(*)
470    IF Sums(6)=1 THEN MAT Sumsbkg1= Sums
480    IF Sums(6)=2 THEN MAT Sumsbkg2= Sums
490    IF Sums(6)=3 THEN MAT Sumsbkg3= Sums
```

```
500   IF Sums(6)=4 THEN MAT Sumsbkg4= Sums
510   Cc=Cc+1
520   IF Cc>4 AND Sums(6)=4 THEN 550
530   GOTO 460
540 Bypassbkg:  !
550   DISP "NUMPER OF SCANS TO SKIP INITIAL";
560   INPUT Skip
570   DISP "INPUT NUMBER OF SCANS (MAX 145) TO DISPLAY";
580   INPUT Display
590   DISP "INPUT NUMBER OF SCANS TO SKIP BETWEEN SCANS";
600   INPUT Skip_scan
610   ASSIGN @Ab TO Dfile$
620   ENTER @Ab;Sums(*)
630   Num_scan=Sums(4)
640   ASSIGN @Ab TO Dfile$
650   GOSUB Graphplot
660   FOR Sk=1 TO Skip    !SELECT BEGAINING SCANS TO SKIP IN DISPLAY
670   ENTER @Ab;Sums(*)
680   NEXT Sk
690   Clear
700   FOR Jj=1 TO Display !    Num_scan TO DISPLAY
710   FOR Dd=1 TO Skip_scan+1 !   SELECT NUMBER TO SKIP BETWEEN SCANS
720   ENTER @Ab;Sums(*)
730   NEXT Dd
740   IF Sums(5)<0 THEN 910
750   GLOAD Mass_scale(*)
760   GOSUB Englabel    !ENG DATA OF SCAN
770   MOVE 0,(Y1)
780   FOR I=14 TO Maxstep+13
790   ON Sums(6) GOTO 800,820,840,860
800                    Sumsbkg=Sumsbkg1(I)
810                    GOTO 870
820                    Sumsbkg=Sumsbkg2(I)
830                    GOTO 870
840                    Sumsbkg=Sumsbkg3(I)
850                    GOTO 870
860                    Sumsbkg=Sumsbkg4(I)
870   IF (Sums(I)-Sumsbkg)<=0 THEN 890
880   DRAW I-13,LGT(Sums(I)-Sumsbkg)       !DRAWS SCAN
890   NEXT I
900   GOSUB Store        ! STORES SCAN BY GSTORE INTERNAL STORAGE
910   NEXT Jj
920   FOR Jj=1 TO Display ! NUM_SCAN   CURRENT LIMIT 50 DUE TO MEMORY
930   GOSUB Load          !LOAD DATA TO SCREEN GLOAD
940   WAIT 1               ! ONE SEC BETWEEN SCANS DISP
950   NEXT Jj
960   GOTO 920
970   PAUSE
980 Graphplot:  !************************************************************
990   ! "GRAPHPLOT"
1000  IF Cc<>0 THEN 1010
1010  PEN 0
1020  PLOTTER IS 3,"INTERNAL"
1030  GINIT
1040  ALPHA ON
1050  GRAPHICS OFF
1060! DISP "PLOTTER OR SCREEN";
1070        C$="S"
1080  IF C$="S" OR C$="s" THEN 1130
1090  DISP "SELECT PEN";
```

```
1100  INPUT Pen
1110  PEN Pen
1120  PLOTTER IS 705,"HPGL"
1130!
1140              GCLEAR
1150              ALPHA OFF
1160              GRAPHICS ON
1170 DEG
1180 X1=Maxstep                !360
1190 X2=0
1200 X3=X1+.1*ABS(X2-X1)
1210 X4=X2-.2*ABS(X2-X1)
1220 Y1=LGT(1.E-13)
1230 Y2=LGT(1.E-9)
1240 Y3=Y1-.1*ABS(Y2-Y1)
1250 Y4=Y2+.1*ABS(Y2-Y1)
1260 WINDOW X3,X4,Y3,Y4
1270 LORG 5
1280 CSIZE 3
1290 MOVE 140,-9.5
1300!LABEL "USE OF DATA PROHIBITED WITHOUT APPROVAL"
1310!LABEL "OF PRINICAL TECHNOLOGIST"
1320! FRAME
1330!MOVE X3,Y1+.01*Y1
1340! DRAW X3,Y3
1350! DRAW X1+.06*X1,Y3
1360!MOVE X2-.06*X1,Y4
1370!DRAW X4,Y4
1380! DRAW X4,Y2-.01*Y1
1390 CLIP X1+(.05*ABS(X2-X2)),X2-(.05*ABS(X2-X1)),Y1-(.05*ABS(Y2-Y1)),Y2+(.05*AB
S(Y2-Y1))
1400! CLIP ON
1410  PENUP
1420  DIM A$[80],B$[80]
1430  A$="STEP NUMBER"
1440  B$="ION CURRENT IN AMPERE"
1450  MOVE X1,Y1
1460  DRAW X1,Y2
1470  DRAW X2,Y2
1480  DRAW X2,Y1
1490  DRAW X1,Y1
1500  J=1
1510  FOR X=X1 TO X2 STEP X2-X1
1520  FOR Y=Y1 TO Y2-1 STEP 1
1530! MOVE X,Y    ! DRAW DECADE LINES
1540! DRAW X2,Y   !DRAWS DECADE LINES
1550  FOR I=1 TO 10 STEP 1
1560  MOVE X,Y+LGT(I)
1570  IPLOT .01*J*(X2-X1),0,1
1580  IPLOT -.01*J*(X2-X1),0,1
1590  IF I<10 THEN 1620
1600  IPLOT J*.04*(X2-X1),0,1
1610  IPLOT J*(-.04)*(X2-X1),0,1
1620  NEXT I
1630  NEXT Y
1640  PENUP
1650  J=-1
1660  NEXT X
1670  FOR I=Y1 TO Y2 STEP 1
1680  MOVE X1-.045*(X2-X1),I-.015*(Y2-Y1)
```

```
1690  CLIP OFF
1700  LORG 6
1710  CSIZE 2.5,.6
1720  LABEL "10"
1730  MOVE X1-.016*(X2-X1),I
1740  LORG 5
1750  LABEL INT(I)
1760  CLIP ON
1770  NEXT I
1780  CLIP OFF
1790 MOVE X1-(X2-X1)*.100,(Y2+Y1)/2
1800 LDIR 90                                  !DIRECTION OF YAXIS  NAME
1810 CSIZE 4,.6                               !SIZE OF YAXIS MAME
1820 LORG 6                                   !CENTERS AND LOCATES YAXIS NAME
1830  LABEL (B$)
1840  LORG 1                                  !NORMAL VALUE FOR LORG
1850  PENUP
1860  LDIR 0                                  !NORMAL VALUE FOR LDIR
1870! GOTO 630  ! BY PASS LABEL STEP
1880  FOR I=0 TO X1 STEP 10
1890  MOVE I,Y2
1900  IPLOT 0,-.05
1910  IPLOT 0,+.05
1920  NEXT I
1930  CSIZE 3
1940  LORG 5
1950  FOR I=50 TO X1 STEP 50
1960  MOVE I,Y2
1970  IPLOT 0,-.10
1980  IPLOT 0,+.10
1990  MOVE I,-8.85
2000  LABEL I
2010  NEXT I
2020  MOVE (X2+X1)/2,Y2+.100*(Y2-Y1)
2030  CSIZE 4.5,.6                              !SIZE OF XAXIS NAME
2040  LORG 6                                   !CENTERS AND LOCATES XAXIS NAME
2050  LABEL A$
2060  !
2070  ! "STEP_AMU"*************************************************
2080  ! CAL OF STEP LOCATIONS FROM TWO KNOWN STEPS AND AMU
2090 !DISP "INPUT STEP,1 AMU 1";
2100 !INPUT Step1,Amu1
2110 Step1=26
2120 Amu1=44
2130 !DISP "INPUT STEP 2,AMU 2";
2140 !INPUT Step2,Amu2
2150  ! Step2=221  ! UTD INTEGRATION TEST
2160 Step2=225  ! IVT INTEGRATION TEST
2170 Amu2=14
2180  A=(LOG(Amu2)-LOG(Amu1))/(Step2-Step1)
2190  B=LOG(Amu1)-A*Step1
2200  !*************************************************************
2210 !PRINT "LGT(AMU)= SLOPE *STEP+CONSTANT"
2220 !PRINT "SLOPE = ";A;"    CONSTANT = ";B
2230 !PRINT
2240 !PRINT "AMU","STEP","STEP RANGE"
2250 LORG 5
2260 CSIZE 3
2270  FOR I=1 TO 11
2280  READ Amu
```

```
2290  DATA 44,40,32,30,28,22,20,18,16,14,12
2300  Step=INT((LOG(Amu)-B)/A+.5)
2310  Me(1,I)=Amu
2320  Me(2,I)=Step
2330 !PRINT Amu,Step,Step-2;"-";Step+2
2340 MOVE Step,Y1
2350  IPLOT 0,+.07
2360  IPLOT 0,-.07
2370  MOVE Step,Y1-.03*(Y2-Y1)
2380  LABEL Amu
2390  NEXT I
2400  RESTORE
2410  FOR I=7 TO 50
2420  Step=INT((LOG(I)-B)/A+.5)
2430 MOVE Step,Y1
2440  IPLOT 0,+.025
2450  IPLOT 0,-.025
2460  MOVE Step,Y1
2470  NEXT I
2480  CSIZE 5
2490  LORG 4
2500  MOVE (X1-X2)/2,Y1-.1*(Y2-Y1)
2510  LABEL "MASS NUMBER"
2520  I=44
2530  Step=INT((LOG(I)-B)/A+.5)
2540  LORG 5
2550  CSIZE 3
2560  MOVE Step,-9.5
2570  LABEL "CO2"
2580  I=40
2590  Step=INT((LOG(I)-B)/A+.5)
2600  MOVE Step,-9.5
2610  LABEL "A"
2620  I=32
2630  Step=INT((LOG(I)-B)/A+.5)
2640  MOVE Step,-9.5
2650  LABEL "O2"
2660  I=28
2670  Step=INT((LOG(I)-B)/A+.5)
2680  MOVE Step,-9.5
2690  LABEL "N2/"
2700  LABEL "CO"
2710  I=18
2720  Step=INT((LOG(I)-B)/A+.5)
2730  MOVE Step,-9.5
2740  LABEL "H2O"
2750  GSTORE Mass_scale(*)
2760  RETURN
2770 Englabel:!  ************************************************************
2780          ! PRODUCE SIDE LABEL FOR ENG WORDS
2790          LORG 1
2800          CSIZE 3
2810          MOVE -5,-9.2
2820          LABEL "SUMS"
2830          LABEL ""
2840          LABEL "SERIAL";Sums(1)
2850          LABEL ""
2860          LABEL "FILE ";Sums(2)
2870          LABEL ""
2880          LABEL "INDEX";Sums(3)
```

```
2890          LABEL ""
2900          LABEL "SCANS";Sums(4)
2910          LABEL ""
2920          LABEL "SCAN ";Sums(5)
2930          LABEL ""
2940          LABEL "INT";Sums(6)
2950          LABEL ""
2960          LABEL "DAY";Sums(7)
2970          LABEL ""
2980          LABEL "HOUR";Sums(8)
2990          LABEL ""
3000          LABEL "MIN";Sums(9)
3010          LABEL ""
3020          LABEL "SEC ";Sums(10)
3030          LABEL ""
3040          LABEL "MSEC";Sums(11)
3050          LABEL ""
3060          LABEL "PREAMP";Sums(12)
3070          LABEL ""
3080          LABEL "SOURCE";Sums(13)
3090          RETURN
3100 Store:    !
3110  IF Jj>29 AND Jj<58 THEN 3170
3120  IF Jj>57 AND Jj<86 THEN 3180
3130  IF Jj>85 AND Jj<114 THEN 3190
3140  IF Jj>113 AND Jj<142 THEN 3200
3150  IF Jj>141 THEN 3210
3160 ON Jj GOTO 3220,3240,3260,3280,3300,3320,3340,3360,3380,3400,3420,3440,3460
,3480,3500,3520,3540,3560,3580,3600,3620,3640,3660,3680,3700,3720,3740,3760,3780
3170 ON Jj-29 GOTO 3800,3820,3840,3860,3880,3900,3920,3940,3960,3980,4000,4020,4
040,4060,4080,4100,4120,4140,4160,4180,4200,4220,4240,4260,4280,4300,4320,4340
3180 ON Jj-57 GOTO 4360,4380,4400,4420,4440,4460,4480,4500,4520,4540,4560,4580,4
600,4620,4640,4660,4680,4700,4720,4740,4760,4780,4800,4820,4840,4860,4880,4900
3190 ON Jj-85 GOTO 4920,4940,4960,4980,5000,5020,5040,5060,5080,5100,5120,5140,5
160,5180,5200,5220,5240,5260,5280,5300,5320,5340,5360,5380,5400,5420,5440,5460
3200 ON Jj-113 GOTO 5480,5500,5520,5540,5560,5580,5600,5620,5640,5660,5680,5700,
5720,5740,5760,5780,5800,5820,5840,5860,5880,5900,5920,5940,5960,5980,6000,6020
3210 ON Jj-141 GOTO 6040,6060,6080,6100
3220          GSTORE Pic1(*)
3230          RETURN
3240          GSTORE Pic2(*)
3250          RETURN
3260          GSTORE Pic3(*)
3270          RETURN
3280          GSTORE Pic4(*)
3290          RETURN
3300          GSTORE Pic5(*)
3310          RETURN
3320          GSTORE Pic6(*)
3330          RETURN
3340          GSTORE Pic7(*)
3350          RETURN
3360          GSTORE Pic8(*)
3370          RETURN
3380          GSTORE Pic9(*)
3390          RETURN
3400          GSTORE Pic10(*)
3410          RETURN
3420          GSTORE Pic11(*)
3430          RETURN
```

```
3440            GSTORE Pic12(*)
3450            RETURN
3460            GSTORE Pic13(*)
3470            RETURN
3480            GSTORE Pic14(*)
3490            RETURN
3500            GSTORE Pic15(*)
3510            RETURN
3520            GSTORE Pic16(*)
3530            RETURN
3540            GSTORE Pic17(*)
3550            RETURN
3560            GSTORE Pic18(*)
3570            RETURN
3580            GSTORE Pic19(*)
3590            RETURN
3600            GSTORE Pic20(*)
3610            RETURN
3620            GSTORE Pic21(*)
3630            RETURN
3640            GSTORE Pic22(*)
3650            RETURN
3660            GSTORE Pic23(*)
3670            RETURN
3680            GSTORE Pic24(*)
3690            RETURN
3700            GSTORE Pic25(*)
3710            RETURN
3720            GSTORE Pic26(*)
3730            RETURN
3740            GSTORE Pic27(*)
3750            RETURN
3760            GSTORE Pic28(*)
3770            RETURN
3780            GSTORE Pic29(*)
3790            RETURN
3800            GSTORE Pic30(*)
3810            RETURN
3820            GSTORE Pic31(*)
3830            RETURN
3840            GSTORE Pic32(*)
3850            RETURN
3860            GSTORE Pic33(*)
3870            RETURN
3880            GSTORE Pic34(*)
3890            RETURN
3900            GSTORE Pic35(*)
3910            RETURN
3920            GSTORE Pic36(*)
3930            RETURN
3940            GSTORE Pic37(*)
3950            RETURN
3960            GSTORE Pic38(*)
3970            RETURN
3980            GSTORE Pic39(*)
3990            RETURN
4000            GSTORE Pic40(*)
4010            RETURN
4020            GSTORE Pic41(*)
4030            RETURN
```

```
4040            GSTORE Pic42(*)
4050            RETURN
4060            GSTORE Pic43(*)
4070            RETURN
4080            GSTORE Pic44(*)
4090            RETURN
4100            GSTORE Pic45(*)
4110            RETURN
4120            GSTORE Pic46(*)
4130            RETURN
4140            GSTORE Pic47(*)
4150            RETURN
4160            GSTORE Pic48(*)
4170            RETURN
4180            GSTORE Pic49(*)
4190            RETURN
4200            GSTORE Pic50(*)
4210            RETURN
4220            GSTORE Pic51(*)
4230            RETURN
4240            GSTORE Pic52(*)
4250            RETURN
4260            GSTORE Pic53(*)
4270            RETURN
4280            GSTORE Pic54(*)
4290            RETURN
4300            GSTORE Pic55(*)
4310            RETURN
4320            GSTORE Pic56(*)
4330            RETURN
4340            GSTORE Pic57(*)
4350            RETURN
4360            GSTORE Pic58(*)
4370            RETURN
4380            GSTORE Pic59(*)
4390            RETURN
4400            GSTORE Pic60(*)
4410            RETURN
4420            GSTORE Pic61(*)
4430            RETURN
4440            GSTORE Pic62(*)
4450            RETURN
4460            GSTORE Pic63(*)
4470            RETURN
4480            GSTORE Pic64(*)
4490            RETURN
4500            GSTORE Pic65(*)
4510            RETURN
4520            GSTORE Pic66(*)
4530            RETURN
4540            GSTORE Pic67(*)
4550            RETURN
4560            GSTORE Pic68(*)
4570            RETURN
4580            GSTORE Pic69(*)
4590            RETURN
4600            GSTORE Pic70(*)
4610            RETURN
4620            GSTORE Pic71(*)
4630            RETURN
```

```
4640            GSTORE Pic72(*)
4650            RETURN
4660            GSTORE Pic73(*)
4670            RETURN
4680            GSTORE Pic74(*)
4690            RETURN
4700            GSTORE Pic75(*)
4710            RETURN
4720            GSTORE Pic76(*)
4730            RETURN
4740            GSTORE Pic77(*)
4750            RETURN
4760            GSTORE Pic78(*)
4770            RETURN
4780            GSTORE Pic79(*)
4790            RETURN
4800            GSTORE Pic80(*)
4810            RETURN
4820            GSTORE Pic81(*)
4830            RETURN
4840            GSTORE Pic82(*)
4850            RETURN
4860            GSTORE Pic83(*)
4870            RETURN
4880            GSTORE Pic84(*)
4890            RETURN
4900            GSTORE Pic85(*)
4910            RETURN
4920            GSTORE Pic86(*)
4930            RETURN
4940            GSTORE Pic87(*)
4950            RETURN
4960            GSTORE Pic88(*)
4970            RETURN
4980            GSTORE Pic89(*)
4990            RETURN
5000            GSTORE Pic90(*)
5010            RETURN
5020            GSTORE Pic91(*)
5030            RETURN
5040            GSTORE Pic92(*)
5050            RETURN
5060            GSTORE Pic93(*)
5070            RETURN
5080            GSTORE Pic94(*)
5090            RETURN
5100            GSTORE Pic95(*)
5110            RETURN
5120            GSTORE Pic96(*)
5130            RETURN
5140            GSTORE Pic97(*)
5150            RETURN
5160            GSTORE Pic98(*)
5170            RETURN
5180            GSTORE Pic99(*)
5190            RETURN
5200            GSTORE Pic100(*)
5210            RETURN
5220            GSTORE Pic101(*)
5230            RETURN
```

```
5240            GSTORE Pic102(*)
5250            RETURN
5260            GSTORE Pic103(*)
5270            RETURN
5280            GSTORE Pic104(*)
5290            RETURN
5300            GSTORE Pic105(*)
5310            RETURN
5320            GSTORE Pic106(*)
5330            RETURN
5340            GSTORE Pic107(*)
5350            RETURN
5360            GSTORE Pic108(*)
5370            RETURN
5380            GSTORE Pic109(*)
5390            RETURN
5400            GSTORE Pic110(*)
5410            RETURN
5420            GSTORE Pic111(*)
5430            RETURN
5440            GSTORE Pic112(*)
5450            RETURN
5460            GSTORE Pic113(*)
5470            RETURN
5480            GSTORE Pic114(*)
5490            RETURN
5500            GSTORE Pic115(*)
5510            RETURN
5520            GSTORE Pic116(*)
5530            RETURN
5540            GSTORE Pic117(*)
5550            RETURN
5560            GSTORE Pic118(*)
5570            RETURN
5580            GSTORE Pic119(*)
5590            RETURN
5600            GSTORE Pic120(*)
5610            RETURN
5620            GSTORE Pic121(*)
5630            RETURN
5640            GSTORE Pic122(*)
5650            RETURN
5660            GSTORE Pic123(*)
5670            RETURN
5680            GSTORE Pic124(*)
5690            RETURN
5700            GSTORE Pic125(*)
5710            RETURN
5720            GSTORE Pic126(*)
5730            RETURN
5740            GSTORE Pic127(*)
5750            RETURN
5760            GSTORE Pic128(*)
5770            RETURN
5780            GSTORE Pic129(*)
5790            RETURN
5800            GSTORE Pic130(*)
5810            RETURN
5820            GSTORE Pic131(*)
5830            RETURN
```

```
5840           GSTORE Pic132(*)
5850           RETURN
5860           GSTORE Pic133(*)
5870           RETURN
5880           GSTORE Pic134(*)
5890           RETURN
5900           GSTORE Pic135(*)
5910           RETURN
5920           GSTORE Pic136(*)
5930           RETURN
5940           GSTORE Pic137(*)
5950           RETURN
5960           GSTORE Pic138(*)
5970           RETURN
5980           GSTORE Pic139(*)
5990           RETURN
6000           GSTORE Pic140(*)
6010           RETURN
6020           GSTORE Pic141(*)
6030           RETURN
6040           GSTORE Pic142(*)
6050           RETURN
6060           GSTORE Pic143(*)
6070           RETURN
6080           GSTORE Pic144(*)
6090           RETURN
6100           GSTORE Pic145(*)
6110           RETURN
6120 Load:   !
6130         IF Jj>29 AND Jj<58 THEN 6190
6140         IF Jj>57 AND Jj<86 THEN 6200
6150         IF Jj>85 AND Jj<114 THEN 6210
6160         IF Jj>113 AND Jj<142 THEN 6220
6170         IF Jj>141 THEN 6230
6180 ON Jj GOTO 6240,6260,6280,6300,6320,6340,6360,6380,6400,6420,6440,6460,6480
,6500,6520,6540,6560,6580,6600,6620,6640,6660,6680,6700,6720,6740,6760,6780,6800
6190 ON Jj-29 GOTO 6820,6840,6860,6880,6900,6920,6940,6960,6980,7000,7020,7040,7
060,7080,7100,7120,7140,7160,7180,7200,7220,7240,7260,7280,7300,7320,7340,7360
6200 ON Jj-57 GOTO 7380,7400,7420,7440,7460,7480,7500,7520,7540,7560,7580,7600,7
620,7640,7660,7680,7700,7720,7740,7760,7780,7800,7820,7840,7860,7880,7900,7920
6210 ON Jj-85 GOTO 7940,7960,7980,8000,8020,8040,8060,8080,8100,8120,8140,8160,8
180,8200,8220,8240,8260,8280,8300,8320,8340,8360,8380,8400,8420,8440,8460,8480
6220 ON Jj-113 GOTO 8500,8520,8540,8560,8580,8600,8620,8640,8660,8680,8700,8720,
8740,8760,8780,8800,8820,8840,8860,8880,8900,8920,8940,8960,8980,9000,9020,9040
6230 ON Jj-141 GOTO 9060,9080,9100,9120
6240         GLOAD Pic1(*)
6250         RETURN
6260         GLOAD Pic2(*)
6270         RETURN
6280         GLOAD Pic3(*)
6290         RETURN
6300         GLOAD Pic4(*)
6310         RETURN
6320         GLOAD Pic5(*)
6330         RETURN
6340         GLOAD Pic6(*)
6350         RETURN
6360         GLOAD Pic7(*)
6370         RETURN
6380         GLOAD Pic8(*)
```

```
6390        RETURN
6400        GLOAD Pic9(*)
6410        RETURN
6420        GLOAD Pic10(*)
6430        RETURN
6440        GLOAD Pic11(*)
6450        RETURN
6460        GLOAD Pic12(*)
6470        RETURN
6480        GLOAD Pic13(*)
6490        RETURN
6500        GLOAD Pic14(*)
6510        RETURN
6520        GLOAD Pic15(*)
6530        RETURN
6540        GLOAD Pic16(*)
6550        RETURN
6560        GLOAD Pic17(*)
6570        RETURN
6580        GLOAD Pic18(*)
6590        RETURN
6600        GLOAD Pic19(*)
6610        RETURN
6620        GLOAD Pic20(*)
6630        RETURN
6640        GLOAD Pic21(*)
6650        RETURN
6660        GLOAD Pic22(*)
6670        RETURN
6680        GLOAD Pic23(*)
6690        RETURN
6700        GLOAD Pic24(*)
6710        RETURN
6720        GLOAD Pic25(*)
6730        RETURN
6740        GLOAD Pic26(*)
6750        RETURN
6760        GLOAD Pic27(*)
6770        RETURN
6780        GLOAD Pic28(*)
6790        RETURN
6800        GLOAD Pic29(*)
6810        RETURN
6820        GLOAD Pic30(*)
6830        RETURN
6840        GLOAD Pic31(*)
6850        RETURN
6860        GLOAD Pic32(*)
6870        RETURN
6880        GLOAD Pic33(*)
6890        RETURN
6900        GLOAD Pic34(*)
6910        RETURN
6920        GLOAD Pic35(*)
6930        RETURN
6940        GLOAD Pic36(*)
6950        RETURN
6960        GLOAD Pic37(*)
6970        RETURN
6980        GLOAD Pic38(*)
```

```
6990        RETURN
7000        GLOAD Pic39(*)
7010        RETURN
7020        GLOAD Pic40(*)
7030        RETURN
7040        GLOAD Pic41(*)
7050        RETURN
7060        GLOAD Pic42(*)
7070        RETURN
7080        GLOAD Pic43(*)
7090        RETURN
7100        GLOAD Pic44(*)
7110        RETURN
7120        GLOAD Pic45(*)
7130        RETURN
7140        GLOAD Pic46(*)
7150        RETURN
7160        GLOAD Pic47(*)
7170        RETURN
7180        GLOAD Pic48(*)
7190        RETURN
7200        GLOAD Pic49(*)
7210        RETURN
7220        GLOAD Pic50(*)
7230        RETURN
7240        GLOAD Pic51(*)
7250        RETURN
7260        GLOAD Pic52(*)
7270        RETURN
7280        GLOAD Pic53(*)
7290        RETURN
7300        GLOAD Pic54(*)
7310        RETURN
7320        GLOAD Pic55(*)
7330        RETURN
7340        GLOAD Pic56(*)
7350        RETURN
7360        GLOAD Pic57(*)
7370        RETURN
7380        GLOAD Pic58(*)
7390        RETURN
7400        GLOAD Pic59(*)
7410        RETURN
7420        GLOAD Pic60(*)
7430        RETURN
7440        GLOAD Pic61(*)
7450        RETURN
7460        GLOAD Pic62(*)
7470        RETURN
7480        GLOAD Pic63(*)
7490        RETURN
7500        GLOAD Pic64(*)
7510        RETURN
7520        GLOAD Pic65(*)
7530        RETURN
7540        GLOAD Pic66(*)
7550        RETURN
7560        GLOAD Pic67(*)
7570        RETURN
7580        GLOAD Pic68(*)
```

```
7590        RETURN
7600        GLOAD Pic69(*)
7610        RETURN
7620        GLOAD Pic70(*)
7630        RETURN
7640        GLOAD Pic71(*)
7650        RETURN
7660        GLOAD Pic72(*)
7670        RETURN
7680        GLOAD Pic73(*)
7690        RETURN
7700        GLOAD Pic74(*)
7710        RETURN
7720        GLOAD Pic75(*)
7730        RETURN
7740        GLOAD Pic76(*)
7750        RETURN
7760        GLOAD Pic77(*)
7770        RETURN
7780        GLOAD Pic78(*)
7790        RETURN
7800        GLOAD Pic79(*)
7810        RETURN
7820        GLOAD Pic80(*)
7830        RETURN
7840        GLOAD Pic81(*)
7850        RETURN
7860        GLOAD Pic82(*)
7870        RETURN
7880        GLOAD Pic83(*)
7890        RETURN
7900        GLOAD Pic84(*)
7910        RETURN
7920        GLOAD Pic85(*)
7930        RETURN
7940        GLOAD Pic86(*)
7950        RETURN
7960        GLOAD Pic87(*)
7970        RETURN
7980        GLOAD Pic88(*)
7990        RETURN
8000        GLOAD Pic89(*)
8010        RETURN
8020        GLOAD Pic90(*)
8030        RETURN
8040        GLOAD Pic91(*)
8050        RETURN
8060        GLOAD Pic92(*)
8070        RETURN
8080        GLOAD Pic93(*)
8090        RETURN
8100        GLOAD Pic94(*)
8110        RETURN
8120        GLOAD Pic95(*)
8130        RETURN
8140        GLOAD Pic96(*)
8150        RETURN
8160        GLOAD Pic97(*)
8170        RETURN
8180        GLOAD Pic98(*)
```

```
8190        RETURN
8200        GLOAD Pic99(*)
8210        RETURN
8220        GLOAD Pic100(*)
8230        RETURN
8240        GLOAD Pic101(*)
8250        RETURN
8260        GLOAD Pic102(*)
8270        RETURN
8280        GLOAD Pic103(*)
8290        RETURN
8300        GLOAD Pic104(*)
8310        RETURN
8320        GLOAD Pic105(*)
8330        RETURN
8340        GLOAD Pic106(*)
8350        RETURN
8360        GLOAD Pic107(*)
8370        RETURN
8380        GLOAD Pic108(*)
8390        RETURN
8400        GLOAD Pic109(*)
8410        RETURN
8420        GLOAD Pic110(*)
8430        RETURN
8440        GLOAD Pic111(*)
8450        RETURN
8460        GLOAD Pic112(*)
8470        RETURN
8480        GLOAD Pic113(*)
8490        RETURN
8500        GLOAD Pic114(*)
8510        RETURN
8520        GLOAD Pic115(*)
8530        RETURN
8540        GLOAD Pic116(*)
8550        RETURN
8560        GLOAD Pic117(*)
8570        RETURN
8580        GLOAD Pic118(*)
8590        RETURN
8600        GLOAD Pic119(*)
8610        RETURN
8620        GLOAD Pic120(*)
8630        RETURN
8640        GLOAD Pic121(*)
8650        RETURN
8660        GLOAD Pic122(*)
8670        RETURN
8680        GLOAD Pic123(*)
8690        RETURN
8700        GLOAD Pic124(*)
8710        RETURN
8720        GLOAD Pic125(*)
8730        RETURN
8740        GLOAD Pic126(*)
8750        RETURN
8760        GLOAD Pic127(*)
8770        RETURN
8780        GLOAD Pic128(*)
```

```
8790        RETURN
8800        GLOAD Picl29(*)
8810        RETURN
8820        GLOAD Picl30(*)
8830        RETURN
8840        GLOAD Picl31(*)
8850        RETURN
8860        GLOAD Picl32(*)
8870        RETURN
8880        GLOAD Picl33(*)
8890        RETURN
8900        GLOAD Picl34(*)
8910        RETURN
8920        GLOAD Picl35(*)
8930        RETURN
8940        GLOAD Picl36(*)
8950        RETURN
8960        GLOAD Picl37(*)
8970        RETURN
8980        GLOAD Picl38(*)
8990        RETURN
9000        GLOAD Picl39(*)
9010        RETURN
9020        GLOAD Picl40(*)
9030        RETURN
9040        GLOAD Picl41(*)
9050        RETURN
9060        GLOAD Picl42(*)
9070        RETURN
9080        GLOAD Picl43(*)
9090        RETURN
9100        GLOAD Picl44(*)
9110        RETURN
9120        GLOAD Picl45(*)
9130        RETURN
9140 End: !
9150      END
9160   SUB Clear  ! SUB TO Clear Screen
9170   OUTPUT 2 USING "#,B";255,75  ! USE Clear AS A SINGLE STATEMENT
9180   SUBEND
9190     SUB Config36(Program$,Data$)
9200     DISP
9210     CONTROL KBD,2;1
9220     DISP "SELECT OPTION";
9230     LOOP
9240     ON KEY 0 LABEL "PROGRAM" GOTO 9220
9250     ON KEY 1 LABEL "INT,0" GOTO Pinternal0
9260     ON KEY 2 LABEL "INT,1" GOTO Pinternal1
9270     ON KEY 3 LABEL "700,0" GOTO P7000
9280     ON KEY 4 LABEL "700,1" GOTO P7001
9290     ON KEY 5 LABEL "DATA " GOTO 9230
9300     ON KEY 6 LABEL "INT,0" GOTO Dinternal0
9310     ON KEY 7 LABEL "INT,1" GOTO Dinternal1
9320     ON KEY 8 LABEL "700,0" GOTO D7000
9330     ON KEY 9 LABEL "700,1" GOTO D7001
9340     END LOOP
9350 Pinternal0:    !
9360                Program$=":INTERNAL4,0"
9370                GOTO Subend
9380 Pinternal1:              !
```

```
9390                Program$=":INTERNAL4,1"
9400                GOTO Subend
9410 P7000:        Program$=":,700,0"
9420      GOTO Subend
9430 P7001:         !
9440               Program$=":,700,1"
9450               GOTO Subend
9460 Dinternal0:    !
9470                Data$=":INTERNAL4,0"
9480                GOTO Subend
9490 Dinternal1: !
9500               Data$=":INTERNAL,4,1"
9510               GOTO Subend
9520 D7000:         Data$=":,700,0"
9530               GOTO Subend
9540 D7001:!
9550            Data$=":,700,1"
9560            GOTO Subend
9570 Subend: !
9580          BEEP
9590          Flag=Flag+1
9600          IF Flag=2 THEN 9640
9610          DISP
9620          DISP "SELECT NEXT OPTION";
9630          IF Flag<=1 THEN 9230
9640          PRINT "PROGRAM MSI IS ";Program$
9650          PRINT "DATA MSI IS ";Data$
9660          SUBEND
9670      SUB Config320(Program$,Data$)
9680      CONTROL KBD,2;1
9690  DISP
9700  DISP "SELECT OPTION";
9710  LOOP
9720  ON KEY 1 LABEL "PROGRAM" GOTO 9690
9730  ON KEY 2 LABEL "" GOTO 9710
9740  ON KEY 3 LABEL "" GOTO 9710
9750  ON KEY 4 LABEL "" GOTO 9710
9760  ON KEY 5 LABEL "704,0" GOTO Pinternal0
9770  ON KEY 6 LABEL "704,1" GOTO Pinternal1
9780  ON KEY 7 LABEL "700,0" GOTO Php0
9790  ON KEY 8 LABEL "700,1" GOTO Php1
9800  ON KEY 9 LABEL "DATA" GOTO 9690
9810  ON KEY 10 LABEL "" GOTO 9710
9820  ON KEY 11 LABEL "" GOTO 9710
9830  ON KEY 12 LABEL "" GOTO 9710
9840  ON KEY 13 LABEL "704,0" GOTO Dinternal0
9850  ON KEY 14 LABEL "704,1" GOTO Dinternal1
9860  ON KEY 15 LABEL "700,0" GOTO Dhp0
9870  ON KEY 16 LABEL "700,1" GOTO Dhp1
9880  END LOOP
9890 Pinternal0: !
9900            Program$=":,704,0"
9910            GOTO End
9920 Pinternal1: !
9930            Program$=":,704,1"
9940            GOTO End
9950 Php1:       !
9960            Program$=":,700,1"
9970            GOTO End
9980 Php0:       !
```

```
9990              Program$=":,700,0"
10000             GOTO End
10010 Dinternal0:!
10020             Data$=":,704,0"
10030             GOTO End
10040 Dinternal1:!
10050             Data$=":,704,1"
10060             GOTO End
10070 Dhp1:        !
10080             Data$=":,700,1"
10090             GOTO End
10100 Dhp0:        !
10110             Data$=":,700,0"
10120             GOTO End
10130 End:!
10140     BEEP
10150     Flag=Flag+1
10160     IF Flag=2 THEN 10210
10170     DISP
10180     DISP "SELECT NEXT OPTION";
10190     CONTROL KBD,2;2
10200     IF Flag<=1 THEN 9710
10210     DISP
10220     CONTROL KBD,2;1
10230     SUBEND
```

ATTACHMENT D - SUMS SOFTWARE LISTING

(7) READPEADS:

```
10 !    RE-STORE "READPEAKS"
20 !    REVISION 5/15/90     RJD
30    ! THIS PROGRAM ASSUMES THAT YOU HAVE DETERMINED THE STEP
40    ! AND AMU NUMBERS VALUES FROM THE SUMS PROGRAM
50    ! AND THE CORRECT VALUES ARE IN THE STEPAMU SUB
60    ! THIS IS USED IN DETERMINING THE TIME FOR THE PEAK
70    ! THE PLOT METHOD AND ASSUMES  THAT YOU ARE GOING TO
80    ! PLOT LOG CURRENT VS LINIER TIME AND THAT YOU ARE
90    ! GOING TO CURVE FIT LOG CURRENT VS TIME
100   GINIT
110   GCLEAR
120   PRINTER IS 1
130   OPTION BASE 1
140!   Config36(Program$,Data$)
150    Config320(Program$,Data$)
160   DEG
170   DIM Me(2,12) !ME(1,I) AMU ME(2,I) STEP
180   DIM Yaxis$[80],Xaxis$[80]
190   GOSUB Stepamu  ! CAL STEP AND AMU VALUES  FOR MATRIX Me(  )
200   ! TIME OF PEAK TP=TO+(STEP+13)*(5/374)
210   MASS STORAGE IS Data$
220   CAT
230   DISP "INPUT FILE";
240   INPUT F$
250 ! F$="Peaks01_05"
260 ! FILE SIZE DETERMINED BY (8 BYTE PER DATA POINT*12  DATA PT PER SCAN )(96)
270 ! ONE REC/FILE PER SCAN OR REC/FILE = NUMBER OF SCANS
280   DISP "INPUT REC/FILE FOR ";F$;
290   INPUT Rec_file
300   !     Rec_file=30
310   ALLOCATE Peaks(Rec_file,12)
320   ALLOCATE Times(Rec_file,12)
330   ALLOCATE D(2,Rec_file)
340   Num_scan=Rec_file
350   ASSIGN @Ab TO F$
360   ENTER @Ab;Peaks(*)
370   MASS STORAGE IS Program$
380        !   ALLOCATE Eh(Rec_file,3)
390        !    FOR I=1 TO Rec_file
400        !    Eh(I,1)=Peaks(I,12)
410        !    Eh(I,2)=Peaks(I,5)
420        !    Eh(I,3)=.78
430        !    NEXT I
440        !    CREATE BDAT "TIMF",Rec_file,24
450        !    ASSIGN @Ab TO "TIMF"
460        !    OUTPUT @Ab;Eh(*)
470   ! TIME OF PEAK TP=TO+(STEP+13)*(5/374)
480   FOR I=1 TO Num_scan
490   To=Peaks(I,12)
500   Times(I,12)=To
510   FOR J=1 TO 11
520   Times(I,J)=To+(Me(2,J)+13)*(5/374)
530   NEXT J
540   NEXT I
550   ! LOCATION OF CURRENTS IN PEAKS (I,#)
560   ! (I,1)=44 (I,2)=40 (I,3)=32 (I,4)=30 (I,5)=28 (I,6)=22 (I,7)=20 (I,8)=18
570   ! (I,9)=16 (I,10)=14 (I,11)=12 (I,12) = TIME IN SEC BEGAINING OF SCAN
580   Bkg44=Peaks(1,1)
590   Bkg40=Peaks(1,2)
600   Bkg32=Peaks(1,3)
```

```
610    Bkg30=Peaks(1,4)
620    Bkg28=Peaks(1,5)
630    Bkg22=Peaks(1,6)
640    Bkg20=Peaks(1,7)
650    Bkg18=Peaks(1,8)
660    Bkg16=Peaks(1,9)
670    Bkg14=Peaks(1,10)
680    Bkg12=Peaks(1,11)
690    Timeref=Peaks(1,12)
700    Pepeatplot=0
710    GOSUB Plotpeak
720    Repeatplot=1
730    DISP "ANY MORE ";
740    GOSUB Yesno
750    ON R5 GOTO 710,760,730
760    FOR I=2 TO Num_scan
770 !  PRINT USING 720;I,Peaks(I,12)-Timeref,Peaks(I,1)-Bkg44,Peaks(I,2)-Bkg40,Pe
aks(I,3)-Bkg32,Peaks(I,4)-Bkg30,Peaks(I,5)-Bkg28
780    IMAGE DDD,2X,DDD,2X,5(2X,MD.DDDE)
790    NEXT I
800    GOTO End
810 Stepamu:    !
820 !  DIM Me(2,12)
830    ! "STEP_AMU"
840    ! CAL OF STEP LOCATIONS FROM TWO KNOWN STEPS AND AMU
850   !DISP "INPUT STEP,1 AMU 1";
860   !INPUT Step1,Amu1
870   Step1=26
880   Amu1=44
890   !DISP "INPUT STEP 2,AMU 2";
900   !INPUT Step2,Amu2
910   Step2=225
920   Amu2=14
930    A=(LOG(Amu2)-LOG(Amu1))/(Step2-Step1)
940    B=LOG(Amu1)-A*Step1
950   !PRINT "LGT(AMU)= SLOPE *STEP+CONSTANT"
960   !PRINT "SLOPE = ";A;"    CONSTANT = ";B
970   !PRINT
980   !PRINT "AMU","STEP","STEP RANGE"
990    FOR I=1 TO 11
1000   READ Amu
1010   DATA 44,40,32,30,28,22,20,18,16,14,12
1020   Step=INT((LOG(Amu)-B)/A+.5)
1030   Me(1,I)=Amu
1040   Me(2,I)=Step
1050 !PRINT Amu,Step,Step-2;"-";Step+2
1060   NEXT I
1070   RESTORE
1080   RETURN
1090 Plotpeak: !
1100           IF Repeatplot=1 THEN 1730
1110         !  GCLEAR
1120         GOSUB Plotselect
1130         !
1140         !
1150            !THIS SUB PLOTS THE PEAKS AS A FUNCTION OF REFERENCE SCAN
1160            OFF KEY
1170            Reftime=Times(1,12)
1180            Maxtime=INT(Times(Num_scan,12)-Reftime)+10
1190            WINDOW 0-.2*Maxtime,Maxtime+.1*Maxtime,-15.5,-8.9
```

```
1200          CLIP -.01*Maxtime,Maxtime+.01*Maxtime,-14.05,-8.9
1210          AXES 100,6.,0,-14.,2,6.
1220          AXES 100,-6.,0,-9.0,2,6.
1230          CLIP OFF
1240          MOVE Maxtime,-14
1250          DRAW Maxtime,-9
1260        ! FRAME
1270          J=1!*************THIS DRAWS LOG TIC MARKS**********
1280          FOR X=0 TO Maxtime STEP Maxtime
1290          FOR Y=-14 TO -10 STEP 1
1300          FOR I=1 TO 10 STEP 1
1310          MOVE X,Y+LGT(I)
1320          IPLOT .01*J*Maxtime,0,1
1330          IPLOT -.01*J*Maxtime,0,1
1340          IF I<10 THEN 1370
1350          IPLOT .04*J*Maxtime,0,1
1360          IPLOT -.04*J*Maxtime,0,1
1370          NEXT I
1380          NEXT Y
1390          PENUP
1400          J=-1
1410          NEXT X
1420          CLIP OFF
1430          !************************************************************
1440          FOR I=-14 TO -9 STEP 1          ! *
1450          MOVE -.045*Maxtime,I-.015*(7)   ! *
1460          LORG 6                          ! *
1470          CSIZE 2.5,.6                    ! *
1480          LABEL "10"                      ! *
1490          MOVE -.016*Maxtime,I            ! *
1500          LORG 5                          ! *
1510          LABEL INT(I)                    ! *
1520          NEXT I                          ! *
1530          !************************************************************
1540          FOR I=0 TO Maxtime STEP 200
1550          MOVE I,-14.2
1560          LORG 5
1570          CSIZE 2
1580          LABEL I
1590          NEXT I
1600          LORG 5
1610          CSIZE 3.5,.6
1620          Yaxis$="ION CURRENT - AMP"
1630          Xaxis$="REFERENCE TIME IN SEC"
1640          LDIR 90
1650          LORG 6
1660          CSIZE 3.5
1670          MOVE -.1*Maxtime,-11.5
1680          LABEL Yaxis$
1690          LDIR 0
1700          LORG 5
1710          MOVE Maxtime/2,-14.5
1720          LABEL Xaxis$;Peaks(1,12)
1730          LORG 5
1740          CSIZE 2
1750          Ccc=0
1760      !     FOR Jj=1 TO 11.1 STEP 1
1770      IF Plotter=705 AND Repeatplot=1 THEN 1790
1780      GOTO 1820
1790      DISP "SELECT PEN";
```

```
1800      INPUT Pen
1810      PEN Pen
1820      PRINT "44,40,32,30,28,22,20,18,16,14,12"
1830      PRINT " 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11"
1840      DISP "INPUT PEAK NUMBER TO BE PLOTTED";
1850      INPUT Jj
1860             MOVE Times(1,Jj)-Reftime,LGT(Peaks(1,Jj))
1870            Ccc=Ccc+1
1880            FOR I=2 TO Num_scan
1890       !     MOVE Times(I,JJ)-Reftime,LGT(Peaks(I,JJ)-Bkg28*(JJ=5)-Bkg14*(JJ=
10))
1900             DRAW Times(I,Jj)-Reftime,LGT(Peaks(I,Jj))
1910             D(1,I-1)=Times(I,Jj)-Reftime
1920        !    D(2,I-1)=(Peaks(I,JJ)-Bkg28*(JJ=5)-Bkg14*(JJ=10))
1930             D(2,I-1)=(Peaks(I,Jj))
1940             IF Ccc>1 THEN 1970
1950           ! LABEL "X"
1960             GOTO 1990
1970          !  LABEL "*"
1980        !    PRINT USING "DDD,3X,DD.DDD";I,((Peaks(I,10)-Bkg14)/(Peaks(I,5)-B
kg28))*100
1990             NEXT I
2000             GOSUB Poly
2010         !   NEXT Jj
2020             RETURN
2030 Poly: !
2040!       SUBS REQUIRED YESNO,ENTRY1,ENTRY2,ENTRY3,PLOTSELECT
2050 REM    ******************REGRESSION ANALYSIS    ************************
2060 REM*************************************************************************
2070   No=Num_scan
2080   Vx=1
2090   Vy=2
2100   Second=0
2110 ! PLOTTER IS 3,"INTERNAL"
2120 !  Plotter=0
2130  ! Pu=0
2140   PRINT "Do You Wish A Polynomial Regression of the Data"
2150   BEEP
2160   WAIT 1
2170   BEEP
2180   GOSUB Yesno
2190   ON R5 GOTO 2210,2200,2100
2200   GOTO 5010
2210   DISP "INPUT FROM SCAN # TO SCAN #";
2220   INPUT Scan1,Scan2
2230   Numscan=Scan2-Scan1+1
2240   DIM Dd(255),E(50)
2250   LOOP
2260   L5=0
2270   ON KEY 1 LABEL "LIN-LIN" GOTO 2320
2280   ON KEY 2 LABEL "LOGY LINX" GOTO 2340
2290   ON KEY 3 LABEL "LINY LOGX" GOTO 2360
2300   ON KEY 4 LABEL "LOGY LOGX" GOTO 2380
2310   END LOOP
2320   L5=0
2330   GOTO 2400
2340   L5=1
2350   GOTO 2400
2360   L5=2
2370   GOTO 2400
```

```
2380   L5=3
2390   !
2400   OFF KEY
2410 ! PAUSE
2420   GOSUB Prtdevice
2430   FOR I=1 TO 22
2440   Dd(I)=0
2450   E(I)=0
2460   NEXT I
2470   FOR I=23 TO 253
2480   Dd(I)=0
2490   NEXT I
2500   E(1)=1
2510   W=0
2520   Do=0
2530 S1=0
2540   S2=0
2550   S3=0
2560   S4=0
2570   S5=0
2580   IF Second=1 THEN 2690
2590  PRINT "N+1 Data Points Required for Max Degree of N"
2600  PRINT "Run Time is in Direct Relation to Max Degree Value"
2610  PRINT "Max Degree program  Allows  is 20!"
2620   BEEP
2630  PRINT "Input Max Degree for this plot is";Num_scan-1
2640  PRINT "INPUT Degree fit for this Plot"
2650  GOSUB Entry1
2660  ON R5 GOTO 2670,2640,2640
2670        D1=Q5
2680   D2=D1
2690  PRINT "Dgree selected was";D2
2700  IF D2>=No THEN 2590
2710   BEEP
2720          IMAGE DDDD,2DDDDDDDDDDDD.DDDD
2730         IMAGE  2DDDDDDDDDDDD.DDDD
2740   FOR M=Scan1 TO Scan2 STEP 1
2750   IF L5=2 THEN 2790
2760   IF L5=3 THEN 2790
2770   E(2)=D(Vx,M)
2780   GOTO 2800
2790   E(2)=LGT(D(Vx,M))
2800   IF L5=1 THEN 2840
2810   IF L5=3 THEN 2840
2820   Y=D(Vy,M)
2830   GOTO 2850
2840   Y=LGT(D(Vy,M))
2850   FOR I=2 TO D2
2860   E(I+1)=E(I)*E(2)
2870   NEXT I
2880   E(D2+2)=Y
2890   R=0
2900   FOR I=1 TO D2+2
2910   FOR J=I TO D2+2
2920   R=R+1
2930   Dd(R)=Dd(R)+E(I)*E(J)
2940   NEXT J
2950   NEXT I
2960   S1=S1+E(2)
2970   S2=S2+E(2)^2
```

```
2980    S3=S3+Y
2990    S4=S4+Y*Y
3000    S5=S5+E(2)*Y
3010    Do=Do+1
3020    NEXT M
3030    REM
3040    WAIT 1
3050    PRINT "FOR PEAK";Jj;" FROM SCAN ";Scan1;" TO SCAN ";Scan2;"THE COEFFICIEN
TS ARE "
3060 ! PRINT "COEFFICIENTS  "
3070    PRINT "  "
3080    GOTO 3460
3090    T=0
3100    FOR I=1 TO D1+1
3110    E(I)=0
3120    FOR J=1 TO D1-I+2
3130    R=(I+J-1)*(D2+2-.5*(I+J))
3140    E(I)=E(I)+Dd(T+J)*Dd(R)
3150    NEXT J
3160    T=I*(D2+(3-I)/2)
3170    NEXT I
3180    R1=0
3190    FOR I=2 TO D1+1
3200    R1=R1+Dd(I*(D2+(3-I)/2))^2
3210    NEXT I
3220    T0=Dd((D2+1)*(D2+2)/2)
3230    T0=T0-(Dd(D2+1))^2
3240    PRINT "COEFFICIENTS FOR THIS DATA IS IN THE FORM"
3250    IF L5=0 THEN 3290
3260    IF L5=1 THEN 3310
3270    IF L5=2 THEN 3330
3280    IF L5=3 THEN 3350
3290    PRINT "       y = AX^2 + BX^1 + C"
3300    GOTO 3360
3310    PRINT "       LGT(Y) = AX^2 + BX^1 + C "
3320    GOTO 3360
3330    PRINT "       Y = A(LGT X)^2 + B(LGT X)^1  + C"
3340    GOTO 3360
3350    PRINT "       LGT(Y) = A(LGT X)^2 + B(LGT X)^1 + C"
3360    PRINT "  "
3370    IMAGE         DDD ; DDDDDDDDDDDD.DDDD
3380    FOR I=1 TO D1+1
3390    PRINT "E(";I-1;")=  ";E(I)
3400    NEXT I
3410    PRINT "  "
3420    PRINT "R SQUARED = ";R1/T0
3430    PRINT "  "
3440    GOTO 3860
3450    PAUSE
3460    P=1
3470    W=1
3480    D2=D2+1
3490    FOR J=1 TO D2
3500    IF Dd(P)<0 THEN 4960
3510    Dd(P)=SQR(Dd(P))
3520    FOR I=1 TO D2-J+1
3530    Dd(P+I)=Dd(P+I)/Dd(P)
3540    NEXT I
3550    R=P+I
3560    S=R
```

```
3570   FOR L=1 TO D2-J
3580   P=P+1
3590   FOR M=1 TO D2+2-J-L
3600   Dd(R+M-1)=Dd(R+M-1)-Dd(P)*Dd(P+M-1)
3610   NEXT M
3620   R=R+M-1
3630   NEXT L
3640   P=S
3650   NEXT J
3660   T=(D2+1)*(D2+2)/2
3670   FOR I=1 TO D2-1
3680   T=T-1-I
3690   Dd(T)=1/Dd(T)
3700   FOR J=1 TO D2-I
3710   P=D2+1-I-J
3720   P=P*(D2+1-(P-1)/2)-I
3730   R=P-J
3740   S=0
3750   U=I+J+1
3760   V=P
3770   FOR K=1 TO J
3780   V=V+U-K
3790   S=S-Dd(R+K)*Dd(V)
3800   NEXT K
3810   Dd(P)=S/Dd(R)
3820   NEXT J
3830   NEXT I
3840   Dd(1)=1/Dd(1)
3850   GOTO 3090
3860   PRINT "STASTICS FOR PLOT ";G
3870   PRINT "  "
3880   IF Pr=1 THEN 3920
3890   S8=SQR((S2-S1^2/Do)/(Do-1))
3900   S9=SQR((S4-S3^2/Do)/(Do-1))
3910   R9=(S5-S1*S3/Do)/(Do-1)/S8/S9
3920   PRINT "NUMBER OF POINTS = ";Do
3930   PRINT "  "
3940   PRINT "X:  MEAN = ";S1/Do;"      ";"ST. DEV. =";S8
3950   PRINT "Y   MEAN = ";S3/Do;"      ";"ST. DEV. =";S9
3960   PRINT "   "
3970   PRINT "CORR. COEFF.. = ";R9
3980   PRINT "  "
3990   PRINT "TABLE FOR PLOT";G
4000   PRINT "  "
4010   PRINT "          X                    Y                    CAL Y
 Y-CAL Y"
4020   E5=0
4030   FOR M=Scan1 TO Scan2
4040   IF L5=2 THEN 4080
4050   IF L5=3 THEN 4080
4060   I=D(Vx,M)
4070   GOTO 4090
4080   I=LGT(D(Vx,M))
4090   Y=E(D1+1)
4100   FOR J=D1 TO 1 STEP -1
4110   Y=Y*I+E(J)
4120   NEXT J
4130   IF L5=1 THEN 4170
4140   IF L5=3 THEN 4170
4150   PRINT USING 4180;D(Vx,M),D(Vy,M),Y,Y-D(Vy,M)
```

```
4160    GOTO 4200
4170    PRINT USING 4190;D(Vx,M),D(Vy,M),10^Y,D(Vy,M)-10^Y
4180    IMAGE  5X,MD.DDDE,10X,MD.DDDE,10X,MD.DDDE,10X,MD.DDDE
4190    IMAGE 3X,  MD.3DE,9X,MD.3DE,5X,MD.3DE,5X,MD.3DE,DDDDDD.DDD
4200    IF L5=1 THEN 4240
4210    IF L5=3 THEN 4240
4220    E4=(D(Vy,M)-Y)^2
4230    GOTO 4250
4240    E4=(D(Vy,M)-10^Y)^2
4250    E5=E5+E4
4260    NEXT M
4270    E6=(E5/(Do-1))^.5
4280    PRINT "STD DEV OF Y-Y CAL = ";E6
4290    PRINT "  "
4300 !  IF Pr=1 THEN 3790
4310 !  GOSUB 10980   NOTE OPTION FOR HARD COPY
4320 !  IF Pr=1 THEN 2700
4330  !  Pr=0
4340  !  PRINTER IS 1
4350    DISP " PLOT THE EQUATION";
4360    GOSUB Yesno
4370    ON R5 GOTO 4390,4700,4350
4380  !  GOTO 4580
4390     IF L5<2 THEN 4500
4400    PRINT "INPUT Xmin,Xmax,NUMBER OF POINTS PER DECADE"
4410    GOSUB Entry3
4420    ON R5 GOTO 4430,4400,4400
4430    Ao=Q2
4440    Bo=Q3
4450    C=Q4
4460     Ao=LGT(Ao)
4470     Bo=LGT(Bo)
4480     C=1/C
4490     GOTO 4560
4500     PRINT " INPUT Xmin,Xmax,STEP"
4510     GOSUB Entry3
4520     ON R5 GOTO 4530,4500,4500
4530           Ao=Q2
4540           Bo=Q3
4550           C=Q4
4560     PENUP
4570     FOR I=Ao TO Bo STEP C
4580     X=I
4590     Y=E(D1+1)
4600     FOR J=D1 TO 1 STEP -1
4610     Y=Y*X+E(J)
4620     NEXT J
4630     PLOT X,Y,1
4640 !   PLOT X,LGT(Y),1
4650     NEXT I
4660     PENUP
4670     DISP "is Fit OK";
4680     GOSUB Yesno
4690     ON R5 GOTO 4700,2060,4530
4700     DISP "WANT SELECTED PRINT OUT";
4710     GOSUB Yesno
4720     ON R5 GOTO 4730,4940,4700
4730     PRINT "INPUT Xmin,XMax,STEP"
4740     GOSUB Entry3
4750     ON R5 GOTO 4760,4730,4730
```

```
4760          Ao=Q2
4770          Bo=Q3
4780          C=Q4
4790    FOR I=Ao TO Bo STEP C
4800    X=I
4810    Y=E(D1+1)
4820    FOR J=D1 TO 1 STEP -1
4830    Y=Y*X+E(J)
4840    NEXT J
4850    IF L5=1 THEN 4890
4860    IF L5=1 THEN 4890
4870    PRINT X,Y
4880    GOTO 4900
4890    PRINT X,10^Y
4900    NEXT I
4910  ! IF Pr=1 THEN 4460
4920  ! GOSUB Prtdevice  !ECK ORIGNAL PROGRAM FOR THIS EFFECT
4930 !  IF Pr=1 THEN 4310
4940  ! PRINTER IS 1
4950    GOTO 5010
4960    DISP " D(P)  NEGATIVE Will Reprocess at the next lower Fit";
4970    D1=D1-1
4980    D2=D1
4990    Second=1
5000    GOTO 2210
5010    PRINT J
5020    RETURN
5030   REM*****************************************************************
5040   REM*****************************************************************
5050 Yesno:  REM    yes  no sub ************************************************
5060   REM*******************************
5070   REM RETURNS R5 = 1,2 OR 3
5080   LOOP
5090   ON KEY 1 LABEL "YES" GOTO 5150
5100   ON KEY 2 LABEL "" GOTO 5080
5110   ON KEY 3 LABEL "" GOTO 5080
5120   ON KEY 4 LABEL "NO" GOTO 5180
5130   ON KEY 5 LABEL "REPEAT ?" GOTO 5210
5140   END LOOP
5150   R5=1
5160   OFF KEY
5170   RETURN
5180   R5=2
5190   OFF KEY
5200   RETURN
5210   R5=3
5220   OFF KEY
5230   RETURN
5240   REM*********************************************************
5250 Entry1:  REM    **sub for single entry and check*******************
5260   REM ***YES NO SUB REQUIRED     ****************************
5270   REM ***RETURNS VALUE OF Q5     ****************************
5280   DISP " INPUT NUMBER FOR ENTRY 1";
5290   INPUT Q5
5300   BEEP 440,.5
5310   DISP "Is Input",Q5,"Correct";
5320   GOSUB Yesno
5330   ON R5 GOTO 5380,5340,5300
5340  BEEP
5350  DISP "Renter Data";
```

```
5360  WAIT 2
5370  BEEP
5380  RETURN
5390  REM*****************************************************
5400 Entry2:  REM sub routine for two numerical entry and check*****************
****
5410  REM*********************************************************
5420  INPUT Q6,Q7
5430  BEEP 880,.5
5440  PRINT "ARE  InputsS",Q6,Q7,"Correct"
5450  GOSUB Yesno
5460  ON R5 GOTO 5510,5470,5430
5470  BEEP
5480  PRINT "Re-input Data"
5490  WAIT 2
5500  BEEP
5510  RETURN
5520  REM*************************************************************
5530 Entry3:  REM  sub routine for three numerical entry and check**************
****
5540  REM***************************************************************
5550  INPUT Q2,Q3,Q4
5560  BEEP 220,.5
5570  PRINT "are Inputs",Q2,Q3,Q4,"Correct"
5580  GOSUB Yesno
5590  ON R5 GOTO 5640,5600,5560
5600 BEEP
5610 PRINT " Re-Enter Data"
5620 WAIT 2
5630 BEEP
5640 RETURN
5650 Plotselect:          !*****************************************************
******************
5660 ON KEY 1 LABEL "SCREEN" GOTO Crtplot
5670 ON KEY 2 LABEL "" GOTO 5650
5680 ON KEY 3 LABEL "" GOTO 5650
5690 ON KEY 4 LABEL "PLOTTER" GOTO Plotter
5700 GOTO 5660
5710 Crtplot:!
5720         Plotter=3
5730 PLOTTER IS 3,"INTERNAL"
5740  RETURN
5750 Plotter:!
5760        Pu=1
5770        Plotter=705
5780  DISP "SELECT PEN TO BE USED";
5790  INPUT Pen
5800  PEN Pen
5810  PLOTTER IS 705,"HPGL"
5820  RETURN
5830 Prtdevice:           !*****************************************************
******************
5840 ON KEY 1 LABEL "SCREEN" GOTO Crt
5850 ON KEY 4 LABEL "PRINTER" GOTO Printer
5860 GOTO 5840
5870 Crt: !
5880 PRINTER IS 1
5890  RETURN
5900 Printer:!
5910  PRINTER IS 701
```

```
5920  RETURN
5930 End: !
5940       PEN 0
5950       PLOTTER IS 705,"HPGL"
5960       PLOTTER IS 3,"INTERNAL"
5970       PRINTER IS 1
5980       END
5990       SUB Config320(Program$,Data$)
6000       CONTROL KBD,2;1
6010  DISP
6020  DISP "SELECT OPTION";
6030  LOOP
6040  ON KEY 1 LABEL "PROGRAM" GOTO 6010
6050  ON KEY 2 LABEL "" GOTO 6030
6060  ON KEY 3 LABEL "" GOTO 6030
6070  ON KEY 4 LABEL "" GOTO 6030
6080  ON KEY 5 LABEL "704,0" GOTO Pinternal0
6090  ON KEY 6 LABEL "704,1" GOTO Pinternal1
6100  ON KEY 7 LABEL "700,0" GOTO Php0
6110  ON KEY 8 LABEL "700,1" GOTO Php1
6120  ON KEY 9 LABEL "DATA" GOTO 6010
6130  ON KEY 10 LABEL "" GOTO 6030
6140  ON KEY 11 LABEL "" GOTO 6030
6150  ON KEY 12 LABEL "" GOTO 6030
6160  ON KEY 13 LABEL "704,0" GOTO Dinternal0
6170  ON KEY 14 LABEL "704,1" GOTO Dinternal1
6180  ON KEY 15 LABEL "700,0" GOTO Dhp0
6190  ON KEY 16 LABEL "700,1" GOTO Dhp1
6200  END LOOP
6210 Pinternal0: !
6220             Program$=":,704,0"
6230             GOTO End
6240 Pinternal1: !
6250             Program$=":,704,1"
6260             GOTO End
6270 Php1:        !
6280             Program$=":,700,1"
6290             GOTO End
6300 Php0:        !
6310             Program$=":,700,0"
6320             GOTO End
6330 Dinternal0: !
6340             Data$=":,704,0"
6350             GOTO End
6360 Dinternal1: !
6370             Data$=":,704,1"
6380             GOTO End
6390 Dhp1:        !
6400             Data$=":,700,1"
6410             GOTO End
6420 Dhp0:        !
6430             Data$=":,700,0"
6440             GOTO End
6450 End: !
6460       BEEP
6470       Flag=Flag+1
6480       IF Flag=2 THEN 6530
6490       DISP
6500       DISP "SELECT NEXT OPTION";
6510       CONTROL KBD,2;2
```

```
6520       IF Flag<=1 THEN 6030
6530       DISP
6540       CONTROL KBD,2;1
6550       SUBEND
6560      SUB Config36(Program$,Data$)
6570      DISP
6580      CONTROL KBD,2;1
6590      DISP "SELECT OPTION";
6600      LOOP
6610      ON KEY 0 LABEL "PROGRAM" GOTO 6590
6620      ON KEY 1 LABEL "INT,0" GOTO Pinternal0
6630      ON KEY 2 LABEL "INT,1" GOTO Pinternal1
6640      ON KEY 3 LABEL "700,0" GOTO P7000
6650      ON KEY 4 LABEL "700,1" GOTO P7001
6660      ON KEY 5 LABEL "DATA " GOTO 6600
6670      ON KEY 6 LABEL "INT,0" GOTO Dinternal0
6680      ON KEY 7 LABEL "INT,1" GOTO Dinternal1
6690      ON KEY 8 LABEL "700,0" GOTO D7000
6700      ON KEY 9 LABEL "700,1" GOTO D7001
6710      END LOOP
6720 Pinternal0:     !
6730                 Program$=":INTERNAL4,0"
6740                 GOTO Subend
6750 Pinternal1:                 !
6760                Program$=":INTERNAL4,1"
6770                GOTO Subend
6780 P7000:        Program$=":,700,0"
6790       GOTO Subend
6800 P7001:         !
6810               Program$=":,700,1"
6820               GOTO Subend
6830 Dinternal0:    !
6840                Data$=":INTERNAL4,0"
6850                GOTO Subend
6860 Dinternal1: !
6870               Data$=":INTERNAL,4,1"
6880               GOTO Subend
6890 D7000:         Data$=":,700,0"
6900               GOTO Subend
6910 D7001:!
6920             Data$=":,700,1"
6930             GOTO Subend
6940 Subend: !
6950          BEEP
6960          Flag=Flag+1
6970          IF Flag=2 THEN 7010
6980          DISP
6990          DISP "SELECT NEXT OPTION";
7000          IF Flag<=1 THEN 6600
7010          PRINT "PROGRAM MSI IS ";Program$
7020          PRINT "DATA MSI IS ";Data$
7030          SUBEND
```

ATTACHMENT D - SUMS SOFTWARE LISTING

(8) PRTALOGI:

```
10 !  RE-STORE "PRTALOGI"
20 OPTION BASE 1
30 ! REVID 9/3/91 RJD
40 GCLEAR
50 WINDOW 170,80,0,100
60 FOR I=0 TO 100 STEP 10
70 MOVE 80,I
80 DRAW 170,I
90 NEXT I
100 Mina=109
110 Maxa=165
120 Stepa=-1
130 PRINT "                                    DATA FROM STS 35"
140 PRINT "                                SNAP SHOT CURRENTS  RANGE OPEN    "
150 PRINT "ALT         I44          I40          I32          I30          I28
  I18"
160!PRINT "ALT         I22          I20          I16          I14          I12"
170 Sens28=1.4E-7
180 Sens44=1.06E-7
190 Sens30=1.4E-7
200 FOR A=Maxa TO Mina STEP Stepa
210 IF A<120 THEN Eq2
220  Logi44=-3.39996943839E-6*A^3+.00164259720176*A^2-.272637024112*A-11.0717288
425
230  Logi40=-6.67822971862E-6*A^3+.00288623467882*A^2-.433767484066*A-3.70674905
086
240  Logi32=-1.10876844076E-5*A^3+.00467169679857*A^2-.674492963902*A+7.93394275
146
250  Logi30=-1.076007971E-6*A^3+.000489810575809*A^2-.0843684705713*A-22.9616362
498
260  Logi28=-9.53710056129E-6*A^3+.00415757698479*A^2-.62197709355*A+9.155199974
05
270  Logi22=7.2000782846E-6*A^3-.00335300363792*A^2+.500149104658*A-54.327737990
6
280  Logi20=-1.41188736997E-5*A^3+.00607903156466*A^2-.8898976321*A+16.325499812
7
290  Logi18=9.04196416696E-7*A^3-.000363257332322*A^2+.0453533532582*A-27.201773
6885
300  Logi16=-2.36433648172E-6*A^3+.00105863374465*A^2-.166055873446*A-17.7450328
67
310  Logi14=-1.08891140566E-5*A^3+.00471523371911*A^2-.699726796246*A+10.0488725
073
320  Logi12=-5.95756266753E-6*A^3+.00276620878653*A^2-.434155011725*A-5.96756024
762
330  GOTO Curr
340 Eq2: !
350 IF A<112 THEN Eq3
360  Logi44=-.000479029457086*A^3+.170486917567*A^2-20.2591644818*A+777.84270777
370  Logi40=-.000943545977077*A^3+.335197148331*A^2-39.7305618079*A+1545.5426021
8
380  Logi32=-.001650393146*A^3+.584387170142*A^2-69.0144981949*A+2693.56074748
390  Logi30=-.00057538096026*A^3+.206742980466*A^2-24.6816402241*A+954.81509290
4
400  Logi28=-.00101198267492*A^3+.359198669644*A^2-42.5397295668*A+1658.92134108
410  Logi22=-.00280091073415*A^3+.974748470492*A^2-113.103209836*A+4346.06575581
420  Logi20=-.00128175199374*A^3+.453828729657*A^2-53.5970196343*A+2084.04800697
430  Logi18=-.0001436930811 9*A^3+.0501038958581*A^2-5.82756687753*A+200.68314034
4
440  Logi16=-.000835789602726*A^3+.296520999279*A^2-35.0876963613*A+1358.3715889
6
```

```
 450  Logi14=-.00126640904043*A^3+.448645768976*A^2-53.0199311996*A+2065.42156084
 460  Logi12=-.000482744702476*A^3+.17446218835*A^2-21.0351370571*A+817.641854947
 470  GOTO Curr
 480 Eq3: !
 490  Logi44=-.000139816456679*A^3+.0699210611223*A^2-10.5000122443*A+469.7496786
 55
 500  Logi40=.00216373097072*A^3-.702337561463*A^2+75.7197619894*A-2735.54441395
 510  Logi32=.00375061936178*A^3-1.23855830426*A^2+136.054998055*A-4995.21850867
 520  Logi30=.0025590466203*A^3-.831917942254*A^2+89.9774111745*A-3264.72206927
 530  Logi28=.0046591321361*A^3-1.5395511213*A^2+169.333569617*A-6220.473954
 540  Logi22=.00925545032532*A^3-3.00541025844*A^2+324.984546687*A-11731.0718179
 550  Logi20=.014003906829*A^3-4.62869597088*A^2+509.698513991*A-18725.1264197
 560  Logi18=.00349770116752*A^3-1.15977400803*A^2+128.154176332*A-4744.46736115
 570  Logi16=.0011375699743*A^3-.360679230384*A^2+37.8541376557*A-1339.62285429
 580  Logi14=-.000458448169879*A^3+.165329177881*A^2-19.9767948199*A+783.39176109
 2
 590  Logi12=-.00020450909363*A^3+.087678391545*A^2-12.2143693232*A+520.6017177
 6
 600 Curr: !
 610  I44=EXP(Logi44)
 620  Di44=I44-Ti44
 630  Ti44=I44
 640  I40=EXP(Logi40)
 650  Di40=I40-Ti40
 660  Ti40=I40
 670  I32=EXP(Logi32)
 680  Di32=I32-Ti32
 690  Ti32=I32
 700  I30=EXP(Logi30)
 710  Di30=I30-Ti30
 720  Ti30=I30
 730  I28=EXP(Logi28)
 740  Di28=I28-Ti28
 750  Ti28=I28
 760  I22=EXP(Logi22)
 770  Di22=I22-Ti22
 780  Ti22=I22
 790  I20=EXP(Logi20)
 800  Di20=I20-Ti20
 810  Ti20=I20
 820  I18=EXP(Logi18)
 830  Di18=I18-Ti18
 840  Ti18=I18
 850  I16=EXP(Logi16)
 860  Di16=I16-Ti16
 870  Ti16=I16
 880  I14=EXP(Logi14)
 890  Di14=I14-Ti14
 900  Ti14=I14
 910  I12=EXP(Logi12)
 920  Di12=I12-Ti12
 930  Ti12=I12
 940  Sens32=2.1979112424E-8*(1-EXP(-8.8226728671E+10*I32))+2.8884202633E-8
 950 !Sens32=5.E-8
 960  ! NOTE BKG VALUE AT 170 KM
 970  Bkg44=2.66E-12
 980  Bkg40=2.19E-12
 990  Bkg32=4.22E-12
1000 Bkg30=4.47E-13
1010 Bkg28=7.73E-11
```

```
1020 Bkg22=4.08E-14
1030 Bkg20=3.65E-13
1040 Bkg18=8.03E-12
1050 Bkg16=1.89E-12
1060 Bkg14=4.47E-13
1070 Bkg12=2.30E-13
1080     !        GOTO Bypassbkg
1090 I44=I44-Bkg44
1100 I40=I40-Bkg40
1110 I32=I32-Bkg32
1120 I30=I30-Bkg30
1130 I28=I28-Bkg28
1140 I22=I22-Bkg22
1150 I20=I20-Bkg20
1160 I18=I18-Bkg18
1170 I14=I14-Bkg14
1180 I12=I12-Bkg12
1190 Bypassbkg:!
1200 P44=I44/Sens44
1210 Dp44=Di44/Sens44
1220 P32=I32/Sens32
1230 Dp32=Di32/Sens32
1240 P28=(I28-.28*I44)/Sens28
1250 Dp28=(Di28-.28*Di44)/Sens28
1260 P40=.013*P28
1270 Dp40=.013*Dp28
1280 P30=I30/Sens30
1290 Dp30=Di30/Sens30
1300 Pt=P44+P40+P32+P30+P28
1310 Dpt=Dp44+Dp40+Dp32+Dp30+Dp28
1320 ! NOTE ABOVE VALUES AT 170 KM
1330 IMAGE DDD.D,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE
1340 PRINT USING 1330;A,I44,I40,I32,I30,I28,I18
1350 PRINT USING 1330;A,P44,P40,P32,P30,P28,Pt
1360 PRINT USING 1330;A,P44*100/Pt,P40*100/Pt,P32*100/Pt,P30*100/Pt,P28*100/Pt,P
t
1370 PRINT USING 1330;A,Dp44,Dp40,Dp32,Dp30,Dp28,Dpt
1380 PRINT USING 1330;A,Dp44*100/Dpt,Dp40*100/Dpt,Dp32*100/Dpt,Dp30*100/Dpt,Dp28
*100/Dpt,Dpt
1390! PRINT USING 680;A,I22,I20,I16,I14,I12
1400!PRINT USING 680;A,I44-2.66E-12,I40-2.19E-12,I32-4.22E-12,I30-4.47E-13,I28-7
.73E-11,I18-8.03E-12
1410! PRINT USING 640;A,I22-4.08E-14,I20-3.65E-13,I16-1.89E-12,I14-4.47E-12,I12-
2.30E-13    !    PRINT MINUS BKG AT 170KM
1420 LORG 5
1430 CSIZE 3
1440 MOVE A,Dp44*100/Dpt
1450 LABEL "*"
1460 MOVE A,Dp40*100/Dpt
1470 LABEL "a"
1480 MOVE A,Dp32*100/Dpt
1490 LABEL "o"
1500 MOVE A,Dp28*100/Dpt
1510 LABEL "N"
1520 IF INT(A/10)=A/10 THEN
1530 MOVE A,95
1540 LABEL A
1550 ELSE
1560 END IF
1570 NEXT A
```

```
1580 Ti44=0
1590 Ti40=0
1600 Ti32=0
1610 Ti30=0
1620 Ti28=0
1630 Ti22=0
1640 Ti20=0
1650 Ti18=0
1660 Ti16=0
1670 Ti14=0
1680 Ti12=0
1690 Mina=87
1700 Maxa=103
1710 Stepa=-1
1720 PRINT
1730 PRINT "
1740 PRINT "                                    DATA FROM STS 35"
1750 PRINT "ALT          I44          I40          I32          I30          I28
   I18"
1760!PRINT "ALT          I22          I20          I16          I14          I12"
1770 FOR A=Maxa TO Mina STEP Stepa
1780 IF A<97 THEN Eq4      ! VALUE BETWEEN 103 AND 97
1790 Logi44=-.00360542514522*A^3+1.11575792389*A^2-115.103295473*A+3931.77695082
!!!!!!
1800 Logi40=-.000239174017114*A^3+.0849132442254*A^2-9.88258177856*A+351.5889584
84
1810 Logi32=.0014596374322*A^3-.42913292246*A^2+41.8675755139*A-1381.65854477
1820 Logi30=-.000414931145786*A^3+.132486381728*A^2-14.0421009898*A+466.27648606
3
1830 Logi28=.00204701200146*A^3-.604382001219*A^2+59.3286401217*A-1959.53062138
1840 Logi22=-.0252758755892*A^3+7.63072963259*A^2-767.804293449*A+25718.5600197
1850 Logi20=.00253351244156*A^3-.736626470121*A^2+71.223882704*A-2318.09169969
1860 Logi18=-.000111799004841*A^3+.0341875503004*A^2-3.47589961284*A+92.16551331
68
1870 Logi16=-.00145676478361*A^3+.448407973725*A^2-46.0280550942*A+1548.6097197
1880 Logi14=.00115550300212*A^3-.334185377593*A^2+32.0319713747*A-1043.21051237
1890 Logi12=-.00750282665275*A^3+2.27159824302*A^2-229.259092551*A+7683.8425057
1900 GOTO Curr2
1910 Eq4:!
1920 IF A<91 THEN Eq5 !  BETWEEN 97  AND 91
1930 Logi44=-.00300366238116*A^3+.819961176856*A^2-74.9856954639*A+2274.2820709
1940 Logi40=.00557819368324*A^3-1.57565861017*A^2+148.014452559*A-4649.46812738
1950 Logi32=-.00525080067453*A^3+1.45544746566*A^2-134.687664042*A+4136.53054556
1960 Logi30=.0105084338565*A^3-2.94601976838*A^2+274.849222559*A-8559.992046
1970 Logi28=-.00218357214495*A^3+.603191468628*A^2-55.8178480622*A+1708.68086232
1980 Logi22=-.00390723301803*A^3+1.07209303303*A^2-98.4578419078*A+2999.60616811
1990 Logi20=.000176373059841*A^3-.0596713555816*A^2+6.21859548953*A-230.84665958
7
2000 Logi18=8.99233060069E-6*A^3-.00063626922976*A^2-.125463123043*A-15.41182924
82
2010 Logi16=-.000957359818024*A^3+.261179344174*A^2-24.0437995783*A+721.87337065
2020 Logi14=-.00521106544876*A^3+1.44548824777*A^2-133.910628392*A+4118.69692754
2030 Logi12=-.0027814042117*A^3+.75441216064*A^2-68.6230884294*A+2065.14579861
2040 GOTO Curr2
2050 Eq5:!       VALUE BETWEEN 91 AND 87
2060 Logi44=.00118798989657*A^3-.324501465118*A^2+29.3151183993*A-898.568511842
2070 Logi40=.00032231909791*A^3-.0970907568585*A^2+9.45953866259*A-324.29323559
2080 Logi32=.00149125285854*A^3-.401869971793*A^2+35.9738298867*A-1093.87582213
2090 Logi30=-.00292624656478*A^3+.754075805076*A^2-64.8476617987*A+1835.93748858
2100 Logi28=.00118390156558*A^3-.319857194552*A^2+28.6474866787*A-871.560101939
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```
2110 Logi22=.00306836660977*A^3-.818328916574*A^2+72.5291202176*A-2162.29380847
2120 Logi20=-4.58528286278E-5*A^3+.00697539950942*A^2-.313764444637*A-20.8472311
236
2130 Logi18=-.00211938628745*A^3+.572299525485*A^2-51.5277269155*A+1521.6020009
2140 Logi16=-.00104184241546*A^3+.286549187005*A^2-26.4391617123*A+793.411909534
2150 Logi14=-.00591056662368*A^3+1.58727567686*A^2-142.222639508*A+4228.06925078
2160 Logi12=.00435824126772*A^3-1.16451528267*A^2+103.494897226*A-3084.73171116
2170 Curr2:!
2180 I44=EXP(Logi44)
2190 Di44=I44-Ti44
2200 Ti44=I44
2210 I40=EXP(Logi40)
2220 Di40=I40-Ti40
2230 Ti40=I40
2240 I32=EXP(Logi32)
2250 Di32=I32-Ti32
2260 Ti32=I32
2270 I30=EXP(Logi30)
2280 Di30=I30-Ti30
2290 Ti30=I30
2300 I28=EXP(Logi28)
2310 Di28=I28-Ti28
2320 Ti28=I28
2330 I22=EXP(Logi22)
2340 Di22=I22-Ti22
2350 Ti22=I22
2360 I20=EXP(Logi20)
2370 Di20=I20-Ti20
2380 Ti20=I20
2390 I18=EXP(Logi18)
2400 Di18=I18-Ti18
2410 Ti18=I18
2420 I16=EXP(Logi16)
2430 Di16=I16-Ti16
2440 Ti16=I16
2450 I14=EXP(Logi14)
2460 Di14=I14-Ti14
2470 Ti14=I14
2480 I12=EXP(Logi12)
2490 Di12=I12-Ti12
2500 Ti12=I12
2510 IMAGE DDD.D,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE,3X,MD.DDE
2520 P44=I44/7.65E-10
2530 Dp44=Di44/7.65E-10
2540 Sens32=(2.1979112424E-8*(1-EXP(-8.8226728671E+10*I32))+2.8884202633E-8)/140
2550 P32=I32/Sens32
2560 Dp32=Di32/Sens32
2570 P30=I30/1.04E-9
2580 Dp30=Di30/1.04E-9
2590 P28=I28/1.04E-9
2600 Dp28=Di28/1.04E-9
2610 P40=.013*P28
2620 Dp40=.013*Dp28
2630  Pt=P44+P40+P32+P30+P28
2640 Dpt=Dp44+Dp40+Dp32+Dp30+Dp28
2650 PRINT USING 2510;A,I44,I40,I32,I30,I28,I18
2660 PRINT USING 2510;A,P44,P40,P32,P30,P28,Pt
2670 PRINT USING 2510;A,P44*100/Pt,P40*100/Pt,P32*100/Pt,P30*100/Pt,P28*100/Pt,P
t
2680 PRINT USING 2510;A,Dp44,Dp40,Dp32,Dp30,Dp28,Dpt
```

```
2690 PRINT USING 2510;A,Dp44*100/Dpt,Dp40*100/Dpt,Dp32*100/Dpt,Dp30*100/Dpt,Dp28
*100/Dpt,Dpt
2700! PRINT USING 640;A,I22,I20,I16,I14,I12
2710 MOVE A,Dp44*100/Dpt
2720 LABEL "*"
2730 MOVE A,Dp40*100/Dpt
2740 LABEL "a"
2750 MOVE A,Dp32*100/Dpt
2760 LABEL "o"
2770 MOVE A,Dp28*100/Dpt
2780 LABEL "N"
2790 IF INT(A/10)=A/10 THEN
2800 MOVE A,95
2810 LABEL A
2820 ELSE
2830 END IF
2840 NEXT A
2850 END
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Willie Wright

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University of Texas at Dallas
P.O. Box 830688
Richardson, TX 75083-0688

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13. ABSTRACT *(Maximum 200 words)*

The Shuttle Upper Atmosphere Mass Spectrometer (SUMS), a component experiment of the NASA Orbital Experiments Program (OEX), was flown aboard the shuttle Columbia (OV102) mounted at the forward end of the nose landing gear well with an atmospheric gas inlet system fitted to the lower fuselage (chin panel) surface. The SUMS was designed to provide atmospheric data in flow regimes inaccessible prior to the development of the Space Transportation System (STS).

The experiment mission operation begins about 1 hour prior to shuttle de-orbit entry maneuver and continues until reaching 1.6 torr (about 86 km altitude). The SUMS flew a total of three missions, 61C, STS-35, and STS-40. Between flights, the SUMS was maintained in flight ready status at the physics laboratory of UTD. The flight data has been analyzed by the NASA LaRC Aerothermodynamics Branch. Flight data spectrum plots and reports are presented in the Appendices to the Final Technical Report for NAS1-17399 as follows:

Attachment A: Flight 61-C Report (Vol. 2)
Attachment B: Flight STS-35 Report (Vol. 3, Vol. 4, Vol. 5, Vol. 6, Vol. 7, and Vol. 8)
Attachment C: Flight STS-40 Report (Vol. 9)
Attachment D: SUMS Software Listing (Vol. 9)

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