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The data acquisition system for diffraction experiments on the Harwell Linac

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ABSTRACT

A suite of programs has been developed for the on-line accumulation of data from the Total Scattering Spectrometer on the Harwell Linac. Facilities are provided for defining the experimental parameters and controlling the sample-changer. There is also provision for users to examine their data and to perform some preliminary data reduction. The data can be sent to the IBM 370/168 Central computer for further processing(1).

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INTRODUCTION

The Linac Total Scattering Spectrometer[2] produces data in the form of pulses from each of up to 8 detectors, each pulse corresponds to the detection of a neutron. The 8 inputs are applied to a time-of-flight scaler[3], together with a delayed start pulse (derived from the master timing unit of the Linac) and a train of timing pulses. The output of the T-of-F scaler consists of a 14-bit word, the 11 low-order bits giving the time of flight of the neutron and the top 3 bits indicate which counter detected the neutron. The data is accumulated in a PDP-11 computer with a disc, for storage of the programs and data, and a CRT display.

The 14-bit descriptor word is transmitted in parallel to a DMA Memory-Increment interface (INC-11) which is set up by the software to contain the base address of a data buffer in core, the descriptor word is multiplied by 2 (to generate a byte address within the buffer) and added to the base address. The core location so addressed is read, incremented, and written back into core. The histogram of the spectrum is thus built up in core, with no need for further sorting of the data. On test, count rates of 100,000 counts/second have been accepted with zero losses.

The computer is coupled via a DR11-C Program interrupt interface to a 6-position sample changer and up to 8 monitor detectors, these are scaled in core. The sample changer may be controlled from any monitor, the number of counts to be scaled in each position is set up by the user when the run is started. When counting in each position is finished, the data in core is added to previously accumulated data on disc. Where it is stored in double precision. The core is then cleared, and counting started in the next position of the cycle. It is not necessary to cycle through all 6 positions, but the cycle always starts at position 0, and steps through consecutive positions. While counting is in progress the data currently being accumulated is displayed on the screen.

In addition to the data accumulation program (DATIN), programs are available for summing data files (SUM), writing the data out to 9-track magnetic tape for transmission to the Central Computer (TAPRIT), and for carrying out preliminary data reduction in the form of background subtractions and spectrum shape correction (RATIO). These programs are described fully in this report.

The PDP-11 operating system under which all the application programs run (currently DOS) also provides facilities for developing and running programs written in Assembler Code (MACRO) and in FORTRAN IV. Jobs may also be run in a batch stream, which can be run whenever the system is not required for on-line data accumulation. Instructions for using any of these facilities are given in the DOS HANDBOOK.

HARDWARE CONFIGURATION

The system (Fig. 1) consists of a PDP-11/10 computer with 56K bytes of core memory and a 2.4M byte moving head demountable cartridge disc. Display of the data is provided by a VR14 point and vector display driven by the VT40 display processor. Hardcopy of the data (numeric or graphic) is provided by a Versatec Model 1110 electrostatic printer/plotter (printing at 1100 LPM, plotting at 2.4"/sec paper speed, 0.010" resolution). The data input from the time-of-flight scaler is via a DMA memory increment interface. Sample changer control and monitor input is through a DR11-C program interrupt interface. The system is controlled through an ASR-33 Teletype. A Read-Only-Memory Bootstrap is provided for system loading.

SOFTWARE CONFIGURATION

The present system is based on the DOS/BATCH operating system, Version 9-20C, this provides a Monitor, for control of the system, loading and running programs, etc., and a library of system Programs (App. C). The system programs are all fully documented in the DOS/BATCH HANDBOOK, which is available to users in the computer room.

The user application programs provided are described in this report. The DOS/BATCH system allows each user to be allocated a unique code (UIC) and a file library is maintained for each UIC. Protection codes may be assigned to reduce the possibility of access by other users.

RUNNING THE SYSTEM

If the system is shut down or does not respond to a Carriage Return typed on the Console Terminal, it will be necessary to re-load as described in Appendix A. Normally however, a C/R typed will cause a $ sign to be printed in response, this indicates that the Monitor is running and has control of the system.

Before any programs can be run, it is necessary for the user to 'LOG-ON' with his own identifier. It is not possible to run any program if not logged-on or logged-on with an identifier that has not been entered in the Master File Directory on the System Disc.

To log-on type:-

LO 117,100

The '117' identifies the user and the '100' is a sub-identifier, used for data accumulation.

The system will accept the command by typing out the current time and another $ prompt, to indicate that it is ready to accept the next command. Any system or application program may be run by typing:-

R NAME

Where 'NAME' is the name of the required program. If the user wants to run a program of his own, held on disc under his own identifier, the 'R' must be replaced by 'RU'. In either case, the program will be loaded into memory and started, the Monitor passing control over to the program but remaining in memory.

The Monitor may be recalled at any time by typing 'CTRL+C', which echoes as '↑C' followed by a '.' on the next line, this indicates that the Monitor has regained control but that there is a program in core. The program can be dropped by typing the 'KI' command, in which case the program is deleted from core but is still held on disc. The Monitor responds with a $ on the next line. A new program may not be run if there is one already in core. A summary of the available Monitor commands is given in Appendix D.

While a program is running, the Monitor may issue error messages, the general format is:–

Lnnn xxxxxx

Where xxxxxx is a 6-digit number giving information about the error
nnn is a 3-digit number identifying the error
L is a letter identifying the error class

Classes are:—

F = Fatal Error, program cannot continue, control reverts to the Monitor.

S = System program Error, usually rejecting the last command.

A = Action Message, requires operator action, followed by 'CO'.

W = Warning Message, execution continues, but may not work correctly.

I = Information Message, execution continues.

The error messages are described in full in the DOS Handbook, which should be consulted whenever an unknown message occurs. DO NOT attempt to continue if you do not know the meaning of a message.

****** WARNING ******

If a program is accessing the disc, the 'KI' command MUST NOT be given until the disc transfer is complete, failure to observe this rule is the most common source of disc corruption and can result in vital disc files being destroyed; the damage may not become apparent until days or weeks later.

The Monitor provides some protection against mistakes but to make it completely 'fool-proof' would require more time and core than can be made available in a small system. Users should, therefore, exercise care when using the system to reduce the risk of damaging mistakes.

DATA ACCUMULATION (DATIN V002D S/C)

1. Log on, using your own user identifier code, these are listed at the computer. DOS will not allow any program to be run unless the user is logged on and DATIN also checks the identifier to ensure that it is in the range [100,000] to [177,100]. If it is outside this range, an error message will be printed, in which case it is necessary to log-off (FI) and then log-on under the correct identifier. A sample dialogue is shown in Fig. 2.

2. Run DATIN by issuing the 'R DATIN' command, DATIN will respond by typing a version number and asking for a file name, this is normally the run number prefixed by an 'R', eg: R1234, DATIN will supply a default filename extension of '. DAT' unless one is specified.

3. A display (Fig. 3) will appear showing the default values of the parameters that are entered in the file header block for the run. Any parameter can be changed by putting the light pen on the 'CHANGE' on the appropriate line, a message will be printed asking for the new value to be entered. After typing the new value, the display will re-appear with the value changed. This process may continue until the values are as required, when the light pen is put on 'START RUN'. At this point the user will be asked for 3 items which cannot be defaulted, namely: run number, initial delay and the user's name.

4. After the initial dialogue is complete, DATIN will allocate the space on disc that it will need to hold the data for the run. If there is insufficient space the message: 'NOT ENOUGH CONTIGUOUS DISC SPACE' will be printed. If this happens it will be necessary either to delete some files from the disc to make space, or start on a second disc pack.

5. DATIN will send the sample changer to position 0 for the start of the run and then wait for the trip to come up, which will indicate that the LINAC is running and data input will then be enabled.

6. If, during the initial dialogue, the number of samples is changed, DATIN will ask for the number of the monitor from which it is to take control, (0 is time in 0.01 sec units, and 1 is LINAC pulses/100, the rest are monitors around the spectrometer). Then the monitor count for each position will be requested, starting at 0, for the number of positions specified. In this case, there will be one file created for each sample changer position and the file name extensions will indicate the position number (eg: '.000', '001', '.002', etc.), an example of a typical starting dialogue is shown in Fig. 1.

7. While data is being accumulated, the current data will be displayed on the screen. Only 1024 channels can be displayed at once, so the starting address of the data displayed is set in the switch register, together with the scaling factor, the settings required are given in Table 1 and Table 2 respectively. If the switch setting is not altered for 20 seconds, the display will be changed to minimum brightness, and will be restored as soon as any switch is changed.

8. To end a run, the command 'END' is typed, this will cause the data to be filed on disc and control to be returned to the Monitor. The user may then either log-off or run any of the applications programs.

SUMMING DATA FILES (SUM V001C)

This program sums up to 5 DATIN type data files together and outputs the result into a file of the same format. A listing of the header block of the data file may optionally be printed. It accepts a standard command string of the form:–

OUTFIL<INFIL1.EXT,INFIL2.EXT,INFIL3.EXT

The input files will be read and some of the information in the header block will be printed.

If more than 5 files are to be summed, then it is necessary to sum them in blocks of 5 or less, creating intermediate files which can then be summed to give the final sum. The intermediate files should be deleted after use.

The output file will have the extension '.DAT' unless one is specified in the command line. If no extensions are given in the input side of the line, then SUM will look for files with the default extension of '.DAT'.

The listing of the header block may be controlled by the use of a 'switch' after the output file name. Two switches are currently available: /NL and /LP, the NL switch indicates that the header listing is not required, and the LP switch directs the listing to the Line Printer. The switches are specified as follows:–

OUTFIL/NL<IN1,IN2.....

or:–

OUTFIL/LP<IN1,IN2.....

If both switches are given, only the first will be accepted, but no error message will be given.

At present, the following information from the header block is printed:-

USER'S NAME
RUN NUMBER
CHANNELS/COUNTER
NUMBER OF COUNTERS
TIME (in units of 0.01 sec.)
P.R.F. (LINAC PULSES/100)
5 MONITORS

In addition, at the end of the summing, the total monitor count is printed, together with the total data count.

SPECTRUM RATIO AND BACKGROUND SUBTRACTION (RATIO V003D)

This program permits the display of selected counters from a 'DATIN' type data file, with the option of subtracting a normalised background and/or correcting for the shape of the incident spectrum.

On loading, RATIO prints it's identification, and a "*" to indicate that it is ready to accept a command line, consisting of up to 4 file specifications. The files must be specified in the correct order:- sample, can, spectrum, background. The first file must be present but any or all of the remainder may be omitted. The files are separated by commas and any missing files are indicated by typing two commas, as shown in the examples.

In order to save time, the calculations are all performed using integer arithmetic and, in the case of the spectrum correction, the data is scaled by 1000, since the ratio is normally centred about a value of 1. This can give rise to some rounding errors but the program is intended to allow an experimenter to examine his data quickly; final analysis being done on the central computer.

The actual calculations carried out are as follows:-

Background Subtraction.

RESULT=SAMPLE-((CAN*SAMPLE MONITOR)/CAN MONITOR)

Spectrum Shape Correction.

RESULT=(SAMPLE*1000)/((SPECTRUM*BACKGROUND MONITOR)/SPECTRUM MONITOR)

If all 4 files are present, then the background is subtracted from the spectrum and the can from the sample, before the spectrum shape correction is calculated.

The default extension on all files is '.DAT', and typical command lines are as follows:-

R2104	(display sample only)
In the following 3 examples, the data is normalised against the monitors.	
R2104, R2105	(subtract R2105 from R2104)
R2104,, R2105	(divide R2104 by R2106)
R2104, R2105, R2106, R2107	(subtract R2107 from R2106, subtract R2105 from R2104, then take the ratio of the results)

After accepting the file specifications, RATIO will ask for the number of the counter to be examined and, in order to display the entire counter on the screen, the 2048 channels will be summed to 1024.

When the data is being displayed, RATIO may be restarted in either of 2 ways, type 'CONTROL+C' and the 'BE' to return to the beginning and examine a different combination of files, or 'RE' to keep the same files and look at a different counter.

The data displayed on the screen may be scaled, using the switch register, as for DATIN and channels may be selected with the light pen, the channel number and contents being displayed at the top of the screen. Data may be plotted by putting the light pen on the word 'PLOT' at the top of the screen, when the picture currently being displayed will be plotted on the Versatec plotter. If the light pen is put on 'LISTKB' then the user is prompted for the starting channel and number of channels to be printed, they will be output to the line printer, the format being governed by whether or not a ratio has been taken, if it has, then the format is '20F6.3', if not, then it is '5110'. The reason for the difference in the formats is that after a ratio has been taken the data is scaled and the output routine converts it to a floating point representation.

The third method of obtaining hardcopy output is to put the light pen on 'LIST LIGHT PEN', when two sets of 3 vertical lines will appear on the screen, these can be positioned by the light pen on either side of the area to be listed, which can then be output by putting the pen on 'PRINT', the starting channel number will be typed.

WRITING THE DATA TO MAGNETIC TAPE (TAPRIT V003C)

This program writes data from 'DATIN' type files to 9-track Magnetic Tape, in a format that can be read on the IBM 370. At present this has to be done on the Nuclear Physics Division PDP-11/45, but a data link is being implemented which will enable it to be done from the On-line computer.

1. log-on, using the identifier of the user whose files are to be written out to tape. The IBM tape should be on Unit 1, and the Write-lock ring in place on the back of the reel.

2. Run TAPRIT, which, on loading, will type out it's identification as follows:–

```
TAPRIT  V003C
SET BIT 7=1  IF NEW TAPE, OR 0 FOR AUTO-SKIP
*
```

The use of bit 7 in the switch register allows the user to write the data from the beginning of the tape (1), in which case any previously written data is over-written, or to skip to the end of the last data written.

3. The tape will be re-wound and positioned as indicated by bit 7, the file specifications of the files to be dumped may now be entered, files are read by default from disc 0, and extensions of '.DAT' are expected, if more files are required than can be typed on one line, then wait until the '*' prompt is typed, and enter the next batch of files, TAPRIT does not rewind the tape between batches, only when it is first loaded.

If the input device is anything other than DK0:, the device need only be specified for the first file, remaining in force until changed explicitly, eg:–

*R1234,R1235,DK1:R1236,R1237,R1238,MT1:R1239,R1240

The above line would read R1234&R1235 from DK0: (the default), R1236,R1237,R1238 from DK1:, and the last two from MT1:, all the files are written to MT0: (this cannot be changed).

Files are always copied in the order in which they are typed on the command line, if input is from Mag-tape, then the tape is re-wound after each file.

REFERENCES

1. Dr. J. H. Clarke AERE - R 8121
2. R. N. Sinclair et al Nucl. Inst. & Methods (1974), 117, 445
3. D. W. Morris AERE - R 7556

TABLE 1

Data selection switches

Data selected by switches 10=>13, 1=switch UP

SWITCH				ADDRESS	COUNTER
13	12	11	10		
0	0	0	0	0	1
0	0	0	1	1024	1
0	0	1	0	2048	2
0	0	1	1	3072	2
0	1	0	0	4096	3
0	1	0	1	5120	3
0	1	1	0	6144	4
0	1	1	1	7168	4
1	0	0	0	8192	5
1	0	0	1	9216	5
1	0	1	0	10240	6
1	0	1	1	11264	6
1	1	0	0	12288	7
1	1	0	1	13312	7
1	1	1	0	14336	8
1	1	1	1	15360	8

TABLE 2

Scale selection switches

Scale selected by switches 0=>2, 1=switch UP

SWITCH			SCALE FACTOR	FULL SCALE
2	1	0		
0	0	0	1	768
0	0	1	2	1536
0	1	0	4	3072
0	1	1	8	6144
1	0	0	16	12288
1	0	1	32	24576
1	1	0	64	49152
1	1	1	128	98304

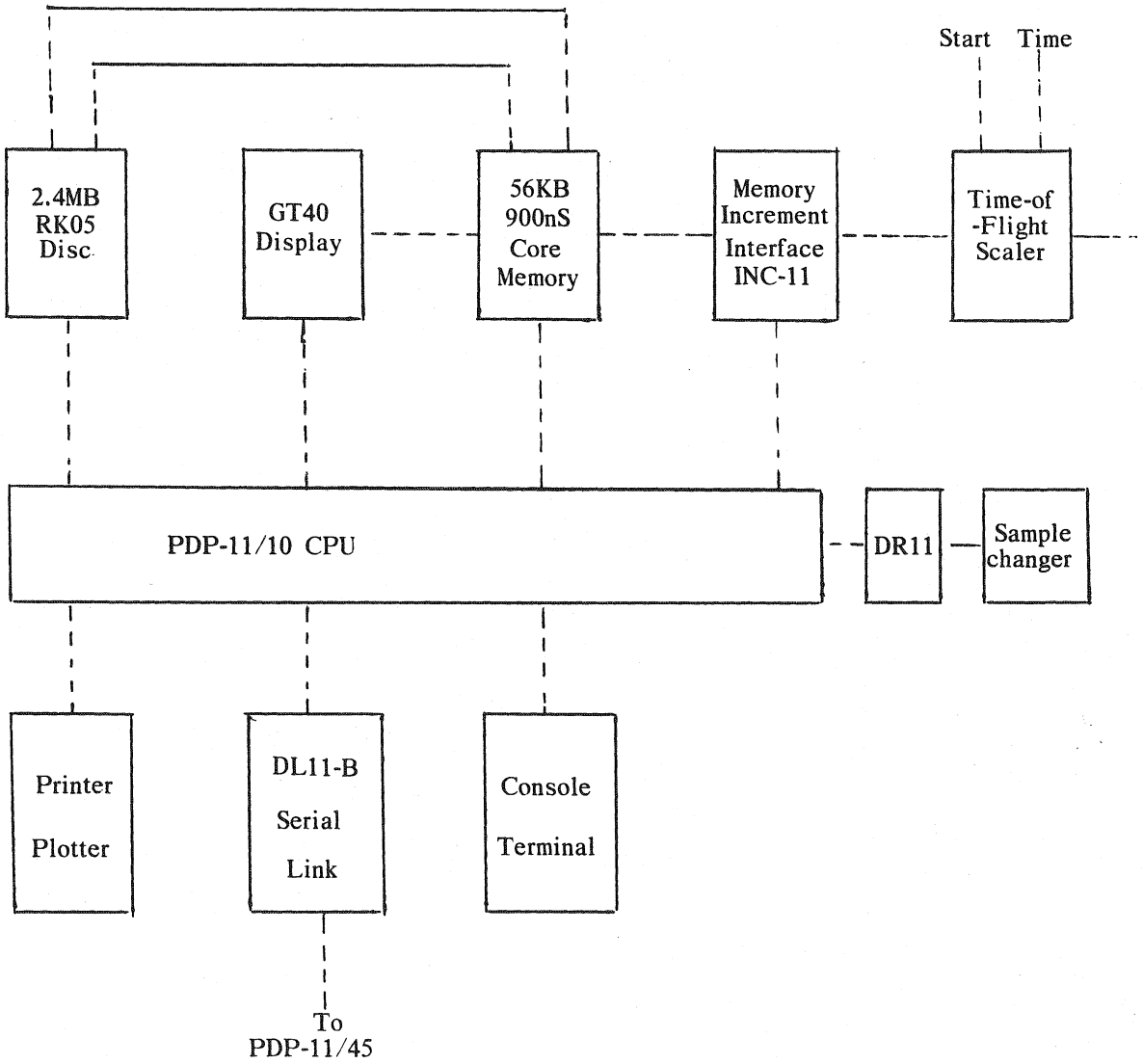

Fig. 1. The computer system block diagram

```
DOS/BATCH V9-20C

$LO 100,100
DATE:-17-SEP-75
TIME:- 15:46:12
$R DATIN
DATIN V002D S/C,  TYPE FILE SPEC. * R1234
TOTAL NO. OF SAMPLES   4
CONTROL MONITOR NUMBER   5
MON. FOR POSN. 0  1500
MON. FOR POSN. 1  3000
MON. FOR POSN. 2  2000
MON. FOR POSN. 3  1500
NO. OF COUNTERS  3
DEAD TIME (US*10)    30
RUN NUMBER:-  1234
INITIAL DELAY, (US*10):-  2500
USERS NAME, ETC.:-  D. A. G. JOHNSON
END

$FI
TIME:- 19:23:17

DOS/BATCH V9-20C

$
```

Fig. 2. Sample DATIN dialogue

```
TOTAL NO. OF SAMPLES                =      2048      CHANGE
NUMBER OF COUNTERS                  =         1      CHANGE
TOTAL FLIGHT PATH LENGTH(mm)        =      4750      CHANGE
SECOND FLIGHT PATH LENGTH(mm)       =       460      CHANGE
DEAD TIME (uS*10)                   =        20      CHANGE
COUNTER 1 ANGLE                     =     15000      CHANGE
COUNTER 2 ANGLE                     =      9000      CHANGE
COUNTER 3 ANGLE                     =      5800      CHANGE
COUNTER 4 ANGLE                     =      3500      CHANGE
COUNTER 5 ANGLE                     =      2000      CHANGE
COUNTER 6 ANGLE                     =      1000      CHANGE
COUNTER 7 ANGLE                     =         0      CHANGE
COUNTER 8 ANGLE                     =         0      CHANGE

START RUN
```

Fig. 3. DATIN initial display

APPENDIX A

LOADING THE SYSTEM

Occasionally, it may be necessary for a user to start the system from 'cold', or when the disc pack has been replaced. The likelihood of either event occurring is remote but users should familiarise themselves with the procedure, in case it should be needed.

1. Ensure that power is on to the system, this is indicated by the lights being on, and the cooling fans running. The on/off switch on the display should also be on (red light on). The 'power' switch on the console must be in the 'on' position (blade horizontal).
N.B. under normal running the key is left in the 'lock' position, it is not possible to start the system if it is in this position, as the console is then locked.

2. Check that a system disc is loaded, the door shut, and switched to 'load', when the disc is up to speed (about 15 secs. from rest) the 'oncyl' and 'rdy' lights will come on. Ensure that the 'WT PROT' light is out, if not, press the 'WT PROT' switch once.

3. Press the 'HALT' key down.
N.B. in the following steps a '1' indicates that the corresponding switch should be UP, values are given in Octal and Binary.

Load 173100 in the switch register (Binary 1 111 011 001 000 000)
Press 'LOAD ADRS'
Set 'HALT' switch UP.
Load 177406 in the switch register (Binary 1 111 111 100 000 110)
Press 'START'

(N.B. if the GT44 system is being used, the above sequence reduces to:–

Press 'HALT'
Load 773010 in the switch register (Binary 111 111 011 000 001 000)
Set 'HALT' switch UP.
Press 'START'

Note that there are 18 switches in the GT44 Switch Register).

The above sequence will cause the ROM Bootstrap to load the operating system from the disc and start it running. The system will then enter an initialisation sequence to set up the internal date and time. The user should reply to the 'DATE :–' prompt by typing in the current date in the format:– 12-SEP-75 (N.B. the separators are 'minus' signs). The time will be asked for next, and should be entered in the format:– 15:35. The next prompt is 'DIALOGUE?' the user should respond with a carriage return to indicate that no dialogue is required. Do NOT attempt to enter the dialogue mode, as this is used solely for system configuration purposes when new hardware is introduced.

The user should next 'LOG-ON' using his own identifier (UIC), which will be allocated to him when he starts his first experiment. An example of the type of print-out obtained is given in Fig. 3.

APPENDIX B

GLOSSARY OF PDP-11 TERMS

ASCII	American Standard Code for Information Interchange, the code used by most teleprinters to represent characters, it is the internal character storage code used by the PDP-11.
BATCH	A system of chaining a series of programs together, to be executed consecutively, without operator intervention.
BOOTSTRAP	A program whose first few instructions are used to load the remainder of the program into memory.
C.S.I.	Command String Interpreter, a routine within DOS(qv), which accepts file specifications and checks for the correct syntax.
COMPILER	A program which accepts a program written in a high-level language (eg:FORTRAN) and translates it into the machine language that is executable by a particular type of computer.
CONSOLE	The front panel of the computer, containing the indicator lights and control switches, the term is also applied to the teleprinter from which the system is controlled.
CONTIGUOUS FILE	A file (usually on disc) in which all the data is stored in physically adjacent blocks (cf:linked file).
CPU	Central Processing Unit, that part of the computer that executes the instructions held in memory.
D.M.A.	Direct Memory Access (sometimes called Data Break), a process by which an external device may access the main memory without affecting the running of a program (cycle stealing).
DOS	Disc based Operating System.
DOUBLE PRECISION	The use of 2 computer words to represent the value of one item of data.
EDITOR	A system program used for preparing and modifying source programs, or any other type of text.
FATAL ERROR	An error from which the program cannot recover, and which therefore causes control to return to the monitor.
FILE STRUCTURED DEVICE	Any device on which data can be stored and retrieved by name through the use of a device directory.
FILE NAME	A word consisting of up to 6 letters and digits, used to identify a file on a file structured device.

FILENAME EXTENSION	A word of up to 3 letters and digits, separated from the name by a period (.) and used to indicate the file type or to differentiate between related files of the same name.
HARDWARE	The physical part of a computer system, the mechanical and electrical components (cf:software).
INTERRUPT	A process by which an external device may cause the running program to be temporarily suspended, a routine entered to service the device, and the program then resumed.
I/O	Input/Output
KB:	Keyboard, or (more generally), the console terminal.
LIBRARIAN	A DOS system program for maintaining a library of commonly used sub-programs.
LINKER	A DOS system program which accepts the output from a compiler or assembler, and links it with any other routines or libraries to produce an executable load module.
LOAD MODULE	The final form of a program, in which it can be loaded into memory for execution.
LP:	Line Printer
MACRO	The DOS assembler
MONITOR	The master control program that supervises the operation of the system. The 'Kernel' of DOS.
OBJECT MODULE	The output from the compiler or assembler, which is input to the linker.
ODT	On-line Debugging Technique, a DOS system facility to aid in the location and correction of errors in a running program.
OVERLAY	A section of program which is held on an external device (eg:disc) and loaded into memory as required, many overlays can use the same section of memory, thus allowing a large program to be run in a small amount of memory.
P.D.P.	Programmed Data Processor
PERIPHERAL	A device, external to the computer, which is used for storage or communication, (eg:disc,printer,etc.).
PIP	Peripheral Interchange Program, a DOS system program used to transfer data between peripheral devices, and to allow access to the file structure of the system.

REAL-TIME	Any processing performed in connection with events occurring in the 'outside world', and constrained by the timing of those events (eg:control and monitoring functions).
ROM	Read Only Memory, a type of memory, so designed that it cannot be modified by the computer. The instructions and/or data are built in when it is made.
SOFTWARE	The programs associated with a computer (cf:hardware), and often including the documentation related to the programs.
STACK	A temporary storage area within the program, of variable size.
SWITCH	A component of the C.S.I(qv) syntax which allows information to be passed to the running program, the syntax requires that each switch be preceded by a slash (/).
SYSTEM PROGRAM	General-purpose and utility programs, provided by the manufacturers, that are available to all users.

APPENDIX C

MONITOR COMMANDS

Command	Prompt	Function	Example
AS	$ or .	Assign a device to a dataset	AS DKO:FIL.EXT,NAME
BE	.	Begin a program.	
CO	$ or .	Continue execution.	
DA	$ or .	Enter or Print the date	DA 12-OCT-75
DU	$ or .	Dump the contents of core	DU LP:,O,10000,47776
EC	$ or .	Turn console echo on/off	
EN	.	Terminate console input	
FI	$	Log-off from the system.	
LO	$	Log-on to the system.	LO 200,201
MO	$ or .	Modify core	MO 12346
OD	.	Start ODT	
PR	.	Turn console output on/off	
RE	.	Restart program (not all are re-startable)	
R	$	Run a system program	R FORTRAN
RU	$	Run a user program	RU MYPROG
SA	.	Save a core image on disc.	SA 10000,17776
ST	.	Stop a program(use 'KI' in preference)	
TI	$ or .	Print or enter the time.	TI 15:36
WA	.	Suspend program.	

APPENDIX D

DATA FILE FORMAT

The data files produced by DATIN consist of a 1024 byte header block, containing a description of the run, followed by the data for one position of the sample changer, in double precision integer (binary) data. There are therefore as many files for each run as there are sample positions. The run number stored in the header block is the run number specified by the user, multiplied by 10, and the sample number specified by the user, multiplied by 10, and the sample number added. For a run number of 1234, and 3 samples, the run numbers stored in the 3 files would be:- 12340, 12341, 12342.

Header Block

Start byte	Number of bytes	Contents	Default
0	4	# of Disc Blocks	Calculated
4	4	Channels/Detector	2048
8	4	Run Number	Typed in
12	12	Date (in ASCII)	Obtained from DOS
24	4	Sample Number	Calculated
28	4	# of Samples	1
32	4	# of Counters	1
36	4	Channel Width*10	20
40	4	Initial Delay*10	Typed in
44	4	Total Flight Path (mm)	4750
48	4	Second Flight Path (mm)	460
52	4	Dead Time*10	20
56	8	Not used	
64	4*8	Monitors for Counter 1	
96	4*8	Monitors for Counter 2	
128	4*8	Monitors for Counter 3	
160	4*8	Monitors for Counter 4	
192	4*8	Monitors for Counter 5	
224	4*8	Monitors for Counter 6	
256	4*8	Monitors for Counter 7	
288	4*8	Monitors for Counter 8	
320	72	Users Name	Typed in
392	120	Spare space	
512	512	Reserved for general text	