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NEW DEVELOPMENT OF TOP SPECTROMETER

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ABSTRACT

We report on the research development of the instrumentation of the TOP installed at the C-3 guide tube looking at the cold neutron moderator at KEK. This paper mainly deals with the newly installed data acquisition system using the PC9801 computer system combined with the time analyser which was also developed at KEK. A new multi dimensional time analyzer system with the position sensitive detectors will be installed near future.

1 INTRODUCTION

We published technical report on the instrumentation using spallation pulsed polarized neutrons, namely the TOP spectrometer installed at the C-3 quide tube looking at the solid methane moderator cooled at about 20K[1-3]. The TOP spectrometer , we believe,was completed as the first instrument which produces polarized neutron pulses with continuous wavelengths, although the wavelength region is longer than 0.3nm . Since then it has continuously been improved and also has been used for numbers of studies on solid state physics. This report is mainly described on the data handling system consisting of 4) the personal computer PC9801, several CAMAC and GPIB modules. Although the cost for this system is relatively low compared with the similar

system using the LSI-11 microcomputer, the performance is satisfactory for our purpose of the data acquisition, analysis and the control of several environmental devices.

In the next section we present the new data handling system together with some examples of data out put. The third section will be devoted to the description of a new time analayzer system for small angle scattering using polarized neutrons, which is now under construction.

2 TOP DATA ACQUISTION SYSTEM

As we described in the previous paper[3] (here after we call paper 1), the TOP instrument is capable to polarize cold pulesed neutrons with a magnetic Soller mirror polarizer[1] and it has been used for various diffraction studies as well as the polarization analysis[5]. Figure 1 depicts a schematic structure of this instrument which is duplicated from the paper 1.

The TOP data acquistion system is aimed to be used for data taking and analyzing and additionally, it is used as the controller of the TOP instrument. The data handling room is located in the building separated from the experimental hall and therefore a terminal was equipped for the sake of remote control as well as communication to the computer in the experimental hall.

The host computer of PC 9801E with ancillary processores, 8 inches disks (20M Byte) and hard disk is able to operate the GPIB and CAMAC modules via GPIB interface board and CAMAC crate controller respectively. Either raw data or their analyzed data are immediately displayed on the color CRT screen and also they are edited on screen. These pictures also turn to the hard copys

immediately. Besides the standard roles as mentioned above an extra role was added that slave computer which is assigned by users can be used as the local station communicating with the big laboratory computer , for instance. Note that the role of master or slave computer is always altered by users convenience.

The data which should be handled are listed below:

1 Digital counts distributed in multichannels of the time analyzers and signals to show the status of the time analyzers.
2 Digital out puts from the multimeters to show the environmental conditions such as temperature.
3 Several warning signals and those from limit switches.

Main controlling items are also listed:

1 The gate of each channnel and switches distributing the digital counts in time analyzers to desired channels.

2 Pulse motor drivers of various goniometers at polarizer, sample and analyzer positions.

3 Power supplies for the magnets for the polarization analyzer, in particular the vector analyzer.

Since the system is oblized to operate in the way of multitask , it was necessary for us to develop an operation system software due to the fact that the real time sharing multi operation system for this particular computer is not available yet. We have introduced a software adaptor of VMX86 with which we could modify the personal computer system to the multitask operating system. The following two figures illustrate the hardware configuration of the TOP data acquisition system and

the conceptual drawing of our multitask system. Concerning the latter figure, we explain more in detail.The real time task of TCFEE always monitors the digital out puts detecting environmental conditions such as temperature and warning signals . The back ground tasks function the way of time slice and they are commanded by users.

Although users are able to access their own made users programs, we have prepared general programs for the purpose of data acquisition , primary data handling, data analysis and data transfer, besides several controlling softwares. The following chart illustrates how the TOP data flow with these prepared softwares. Finally we presesnt here several examples of data displays which are actually colored pictures on the CRT screen. We can obtain the data either by choosing any prepared format or by making user's own format. We can also edit these dataon screen. Users usually transfer the data into the floppy disks and bring them to their own institution with them.

3 TOP MULTI DIMENSIONAL TIME ANALYZER SYSTEM

Although a detector bank for small angle diffraction is equipped now, the TOP spectrometer can not always produce satisfactory data with high resolution. In particulary the small Q data are not taken yet.Therefore we aim to replace it to a position sensitive detector (PSD) system. For that purpose, we must develop the TOP multi demensional time analyzer system (MDTA) which are now under construction. The following schematic drawing illustrates the block diagram for it.

At this moment we will use three linear PSD.Digital signals from each detector are added into the 64 positional channels

times 32 timing channels. The typical resolution in Q/Q is considered to be 0.1 corresponding to the mesh of 1cm in position times 1 msec in time. Since our measurements are dependent on neutron polarization, the additional coincidence with the spin flipper must be taken and the special circuit must be prepared distirubuting the data to at least two different (neutron spin up and down) channels. We aim to have 16 channels in total.

We hope to complete this system before the end of this year and to start the experiment by using this new system at early stage of next year.

To conclude we succeeded to develop the data acquisition system with a personal computer PC 9801. We feel that the cost performance for our system is very good. If we require much higher grade than the present performance we will face the limited capability of personal computer.But we hope that the present TOP data acquisition system can handle the complicated data of polarized neutron small angle scattering measured with a new TOP PSD system.

REFERENCES

1) Y.Endoh,J.Mizuki,Y.Sasaki and H.Ono,P609 Proc,Icans IV KEK, Tsuknba, October 1980

2) Y.Endoh,Y.Sasaki,J.Ono,S.Mitsuda and S.Ikeda, Physica 120B(1983) 45

3) Y.Endoh,S.Ikeda,S.Mitsuda, and H.Fujimoto,Nucl.Instr.Meth.A240 (1985)115

4) S.Mitsuda,Y.Endoh and S.Itoh,KEK Internal 85-13,January 1986 (in Japanese)

5) For instance, Y.Endoh and Y.Ishikawa, Physica 136B(1986) 64,references are there in.

FIGURE CAPTIONS

Fig.1 Schematic drawings of the TOP spectrometer duplicated from paper 1.

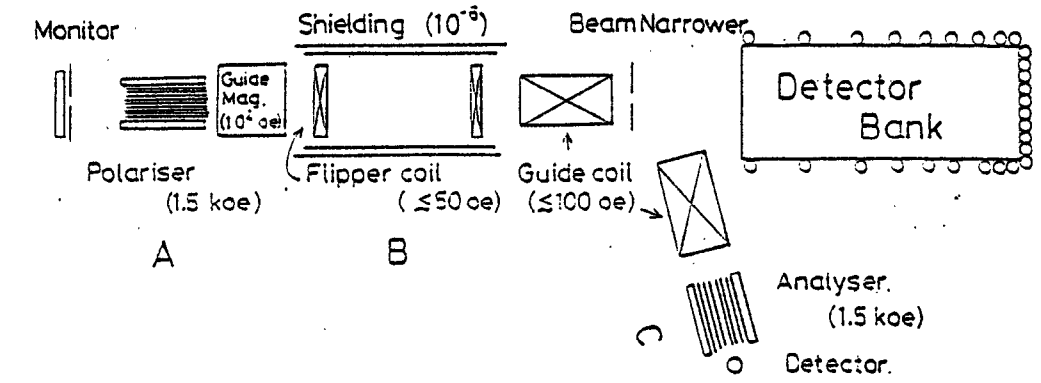
Fig.2 Hardware configuration of the TOP data acquistition system. Master or save computer is assigned by users. (See taxt)

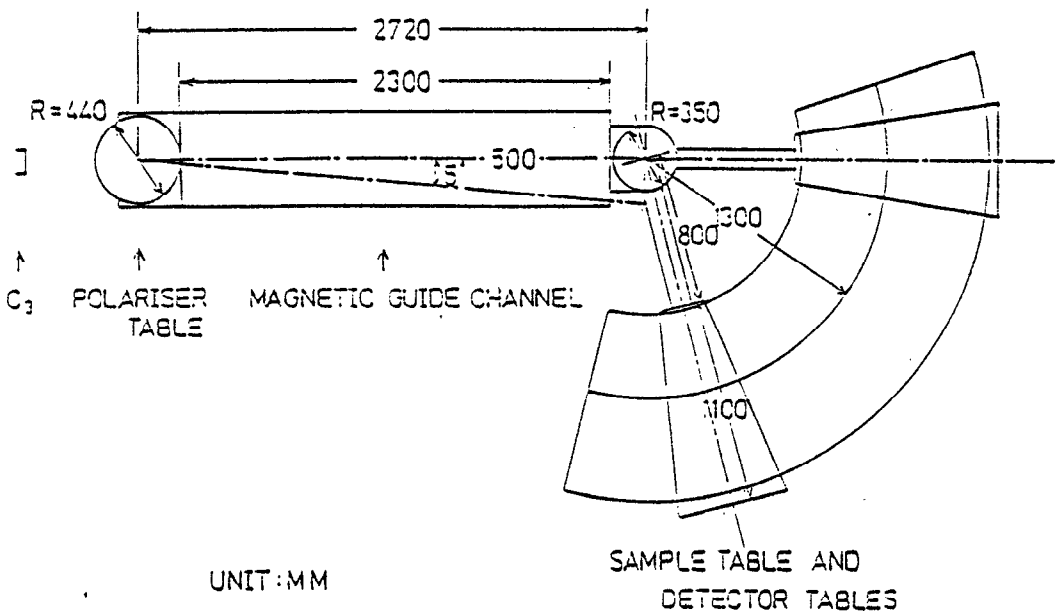
Fig.3 Conceptual drawings of developed multitask operation system of the TOP data acquisition system.

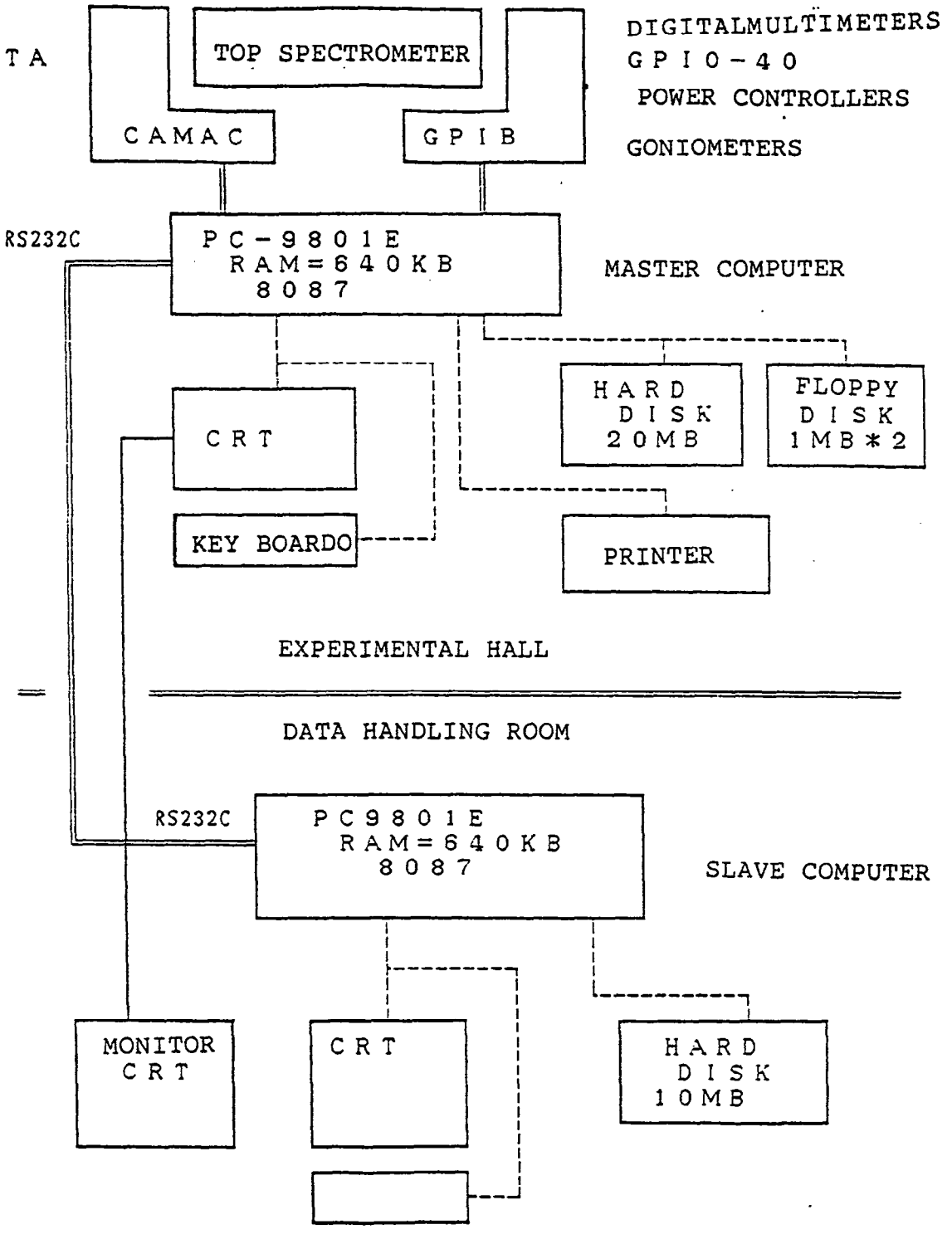
Fig.4 Present data flow through our general softwares for the TOP data acquisition system.

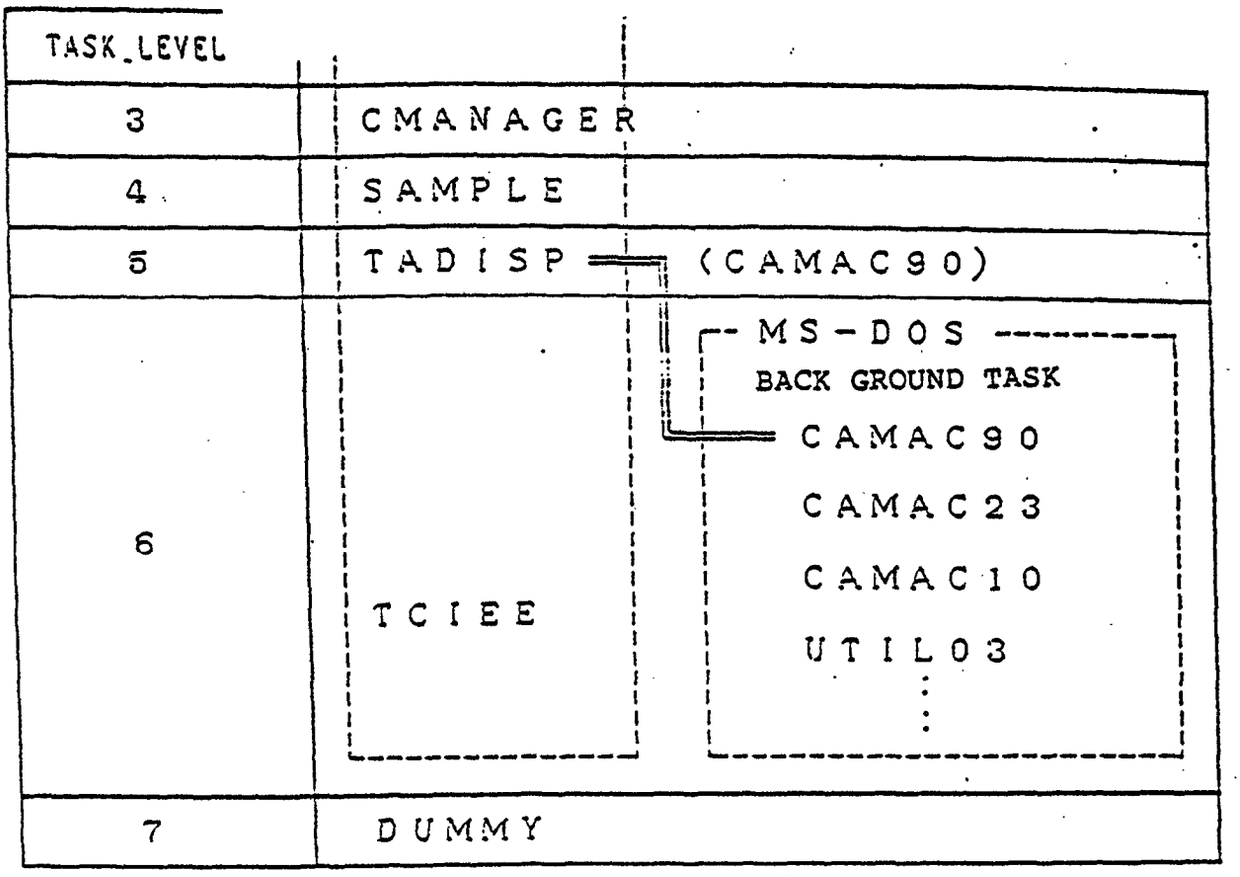
Fig.5 Typical examples of the graphic displays of the data taken with the TOP data acquisition system. (a) Real time display of TA data, (b) display of the information of the data area. (c) The display of data analyzed to the polarization representation.

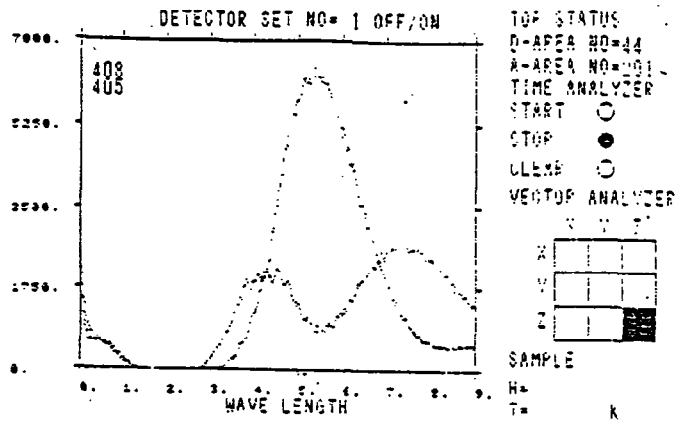
Fig.6 Schematic drawings of the multi dimensional time analyzer system for the linear position sensitive detector.


Monitor
Shielding (10^{-6})
Beam Narrower
Guide Mag. (10^{4} oe)
Detector Bank
Polariser (1.5 koe)
Flipper coil (≲50 oe)
Guide coil (≲100 oe)
A
B
Analyser. (1.5 koe)
Detector.


2720
2300
R=440
R=350
500
15°
300
800
100
C_3
POLARISER TABLE
MAGNETIC GUIDE CHANNEL
SAMPLE TABLE AND DETECTOR TABLES
UNIT : MM


TA
TOP SPECTROMETER
CAMAC
GPIB
DIGITALMULTIMETERS
GPIO-40
POWER CONTROLLERS
GONIOMETERS
RS232C
PC-9801E
RAM=640KB
8087
MASTER COMPUTER
CRT
KEY BOARDO
HARD DISK 20MB
FLOPPY DISK 1MB*2
PRINTER
EXPERIMENTAL HALL
DATA HANDLING ROOM
RS232C
PC9801E
RAM=640KB
8087
SLAVE COMPUTER
MONITOR CRT
CRT
HARD DISK 10MB


TASK_LEVEL
3
CMANAGER
4
SAMPLE
5
TADISP
(CAMAC90)
6
TCIEE
MS-DOS
BACK GROUND TASK
CAMAC90
CAMAC23
CAMAC10
UTIL03
7
DUMMY



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3	T-850620-02 172 171	1985-6 -20 7 -23-2	[illegible] 10*10 MASKED	273.9 1.00
4	T-850620-02 172 171	1985-6 -20 7 -23-2	[illegible] 10*10 MASKED	273.9 1.00
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6	T-850719-03 300 300	1985-7 -19 19-11-17	TEST U-METAL [illegible]	274.9 1.00
7	T-850719-06 79 79	1985-7 -19 19-37-59	TEST OF X-COIL FOR [illegible]	274.9 1.00
8	T-850719-05 197 197	1985-7 -19 19-59-36	TEST OF COIL MAG -	274.9 1.00
9	T-850719-07 22 22	1985-7 -19 19-21-32	TEST OF COIL MAG X	274.9 1.00
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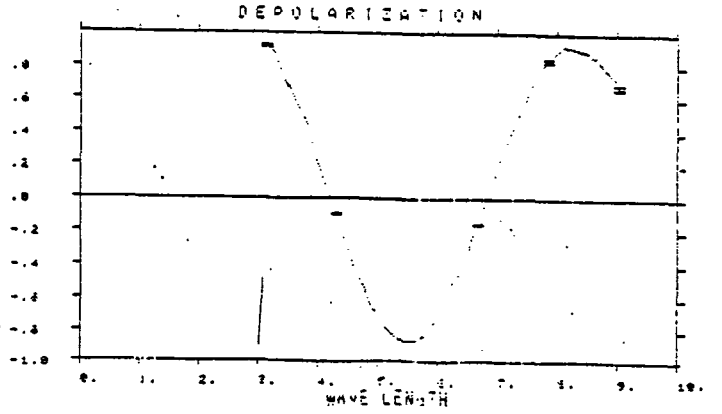

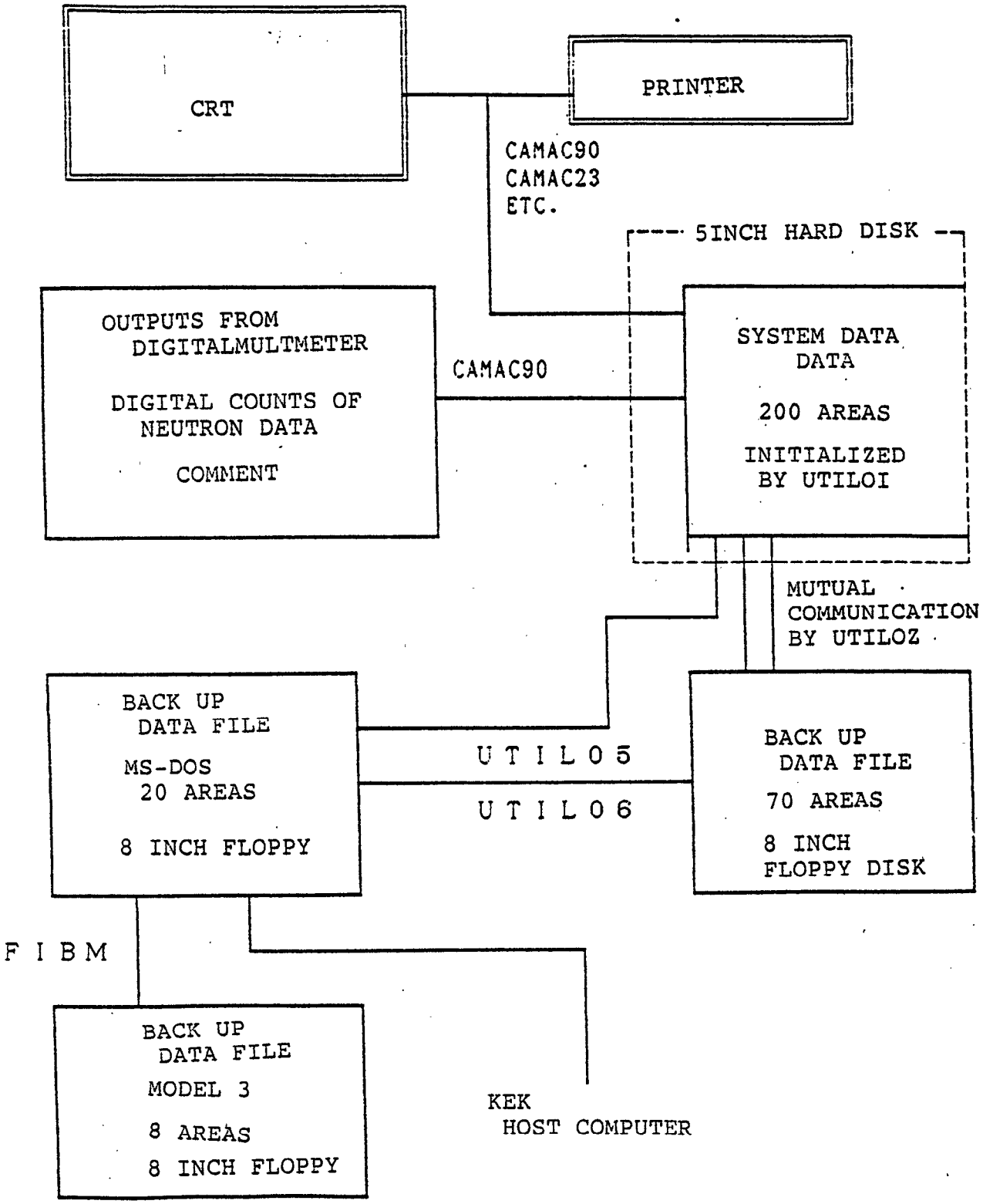
CRT
PRINTER
CAMAC90
CAMAC23
ETC.
5INCH HARD DISK
OUTPUTS FROM
DIGITALMULTMETER
DIGITAL COUNTS OF
NEUTRON DATA
COMMENT
CAMAC90
SYSTEM DATA
DATA
200 AREAS
INITIALIZED
BY UTILOI
MUTUAL
COMMUNICATION
BY UTILOZ
BACK UP
DATA FILE
MS-DOS
20 AREAS
8 INCH FLOPPY
UTIL05
UTIL06
BACK UP
DATA FILE
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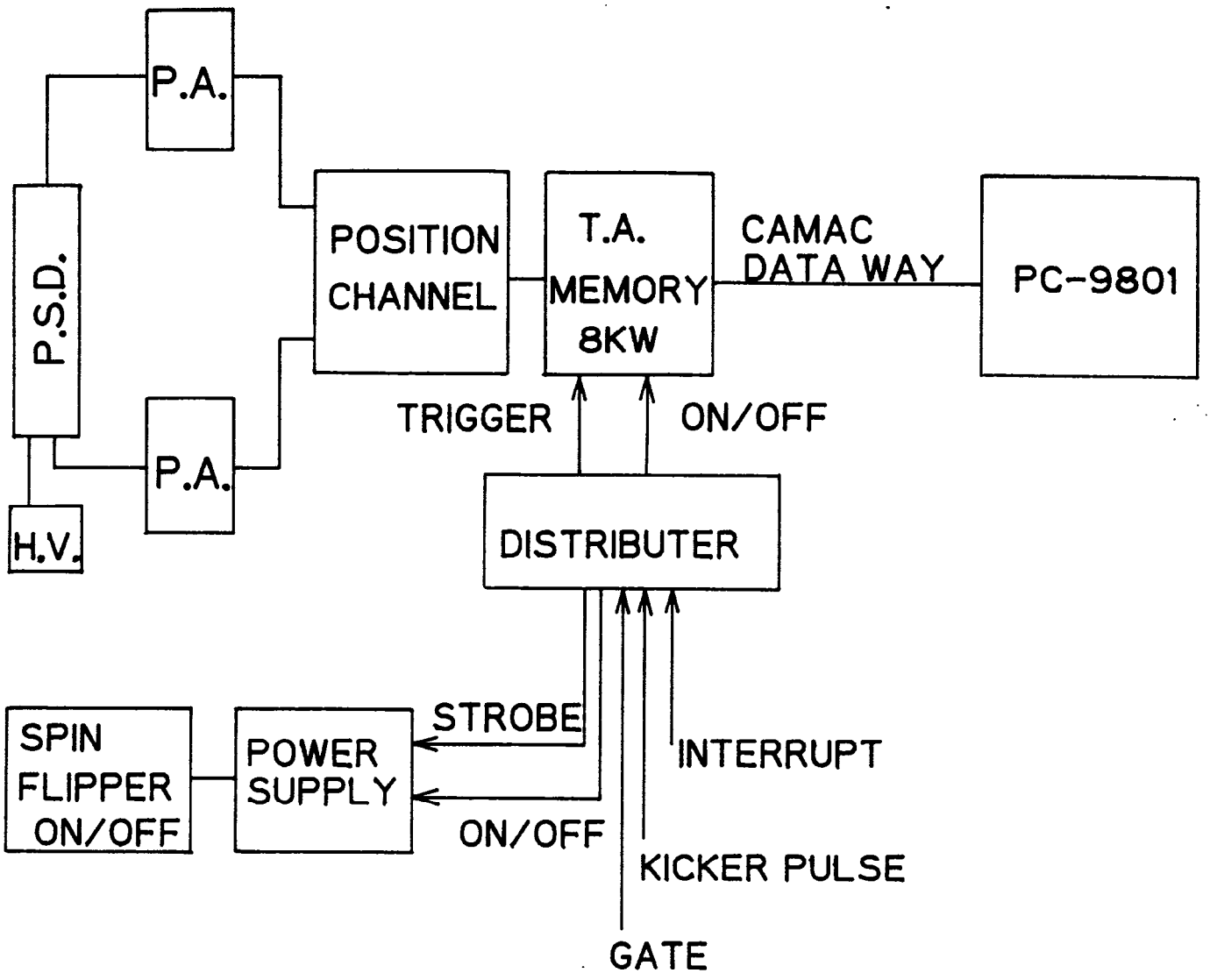
KEK
HOST COMPUTER


P.A.
P.S.D.
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CAMAC DATA WAY
PC-9801
TRIGGER
ON/OFF
P.A.
H.V.
DISTRIBUTER
SPIN FLIPPER ON/OFF
POWER SUPPLY
STROBE
INTERRUPT
ON/OFF
KICKER PULSE
GATE