DEVELOPMENT OF NEW BETA-COUNTING PROGRAMS OPERATING UNDER A WINDOWS® NT WORKSTATION

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ABSTRACT. β-counting software programs were developed and installed in new PCs for operation under a Windows® NT workstation. The new software programs allow us to simultaneously control several β-counting systems, either remotely or from within the laboratory. This setup is much less expensive than our previous arrangement, which required a separate PC for each counter.

INTRODUCTION

At Nihon University, a fully automatic β-counting program and other measuring instruments have been developed since 1982 (Omoto 1982, 1985, 1995). The counting programs were installed and interfaced to several PCs. After developing the programs, I wanted to operate a number of β-counting systems from a single PC and to be able to control them from outside the laboratory. Therefore, the programs were redeveloped to operate with remote capability under a Windows® NT workstation. Although their algorithms are essentially the same as developed previously (Omoto 1982), the new programs provide several very useful functions. In this paper, the significance of the newly developed software programs and hardware systems is reported.

METHODS

Hardware

Figure 1 shows the basic automatic ^{14}C dating system for β-counting without a PC. Our setup consists of four β-counting systems. Previously, each system was composed of a single PC, an interface, a set of amplifiers for center and guard counters, and several measuring instruments. Communications between the PC and measuring instruments were carried out by an interface through an RS-232C cable. Improvements in computer technology prompted us in 1996 to purchase a new host PC and monitor to control all our β-counting systems. A cable connected the new PC to four interfaces; the interfaces were in turn connected to each β-counting system. We prepared a multi serial adapter to expand the cable's lines, and installed a GPIB board to connect several measuring instruments providing GPIB lines. A high-speed modem was purchased and connected to a telephone line for remote-control operation of the host PC. We also purchased equipment to guard against sudden power failure. Table 1 lists the new equipment specifications and manufacturers; Figure 2 details the system setup.

New programs were designed to operate under a Windows® NT workstation. We can now collect, display and store data *via* each interface, *viz.,* time interval for sampling data, figures of anticoincidence, center counter and guard counters, figures of center and guard counter high voltage, temperature and pressure of the counter. Also, timers, high voltage for center and guard counters, and scalers for anticoincidence can be controlled.

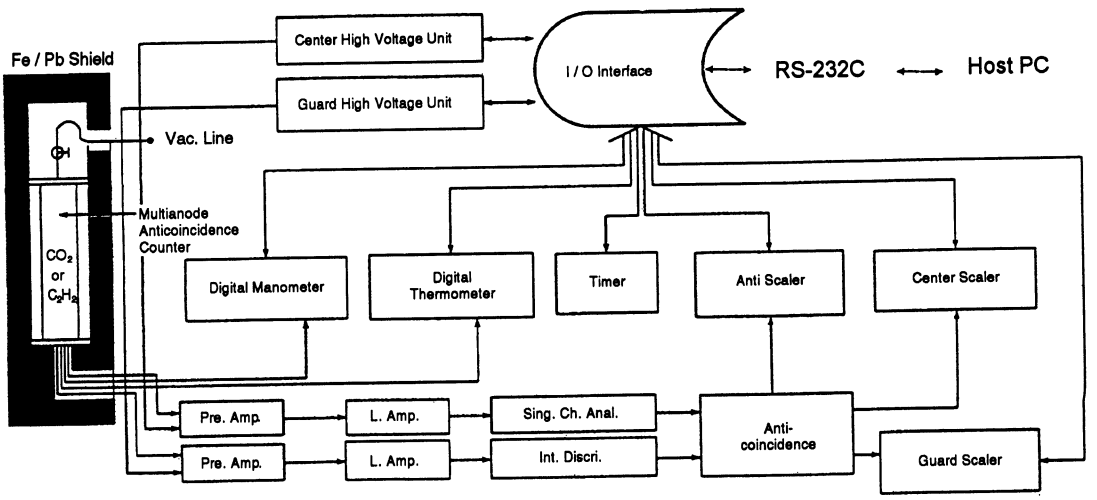

Fig. 1. Schematic diagram of an automatic ^{14}C dating system without PC (adapted from Omoto 1995)

TABLE 1. Specifications of Host PC and Peripheral Instruments Controlling the Automatic ^{14}C Dating System

Instrument	Model	Manufacturer	Accuracy or standard
Computer	Vectra VL5/xx Ser.4	Hewlett Packard® Corp.	CPU: Pentium™ 166 MHz RAM: 128 MB(max) HDD: 2 GB(3.5") CD-ROM: 1 (× 4) FDD: 1 (3.5") Serial Port: 2 Parallel Port: 1
Operating system	Windows® NT workstation V4.0	Microsoft® Corp.	
Display	Ultra VGA 1280	Hewlett Packard® Corp.	17" screen 1280 × 1024 16 color
Printer	LP-8500	Epson Co., Ltd.	A4 & A3 page size
Modem	Sportster® SP-288P	Integran Co., Ltd.	28,800 bps
Power backup	BK Pro™ 500	APC™	500 VA
Expansion board	DigiBoard® PC/8e™	Sumisyo Datacom Inc.	8 ch
GPIB board	AT-GPIB/TNT	National Instruments® Corp.	1.4 MB
Interface	OJY-8201	Yoshiki Co., Ltd.	Input: 5 ch Output: 2 ch Relay: 8 ch Interface: RS-232C

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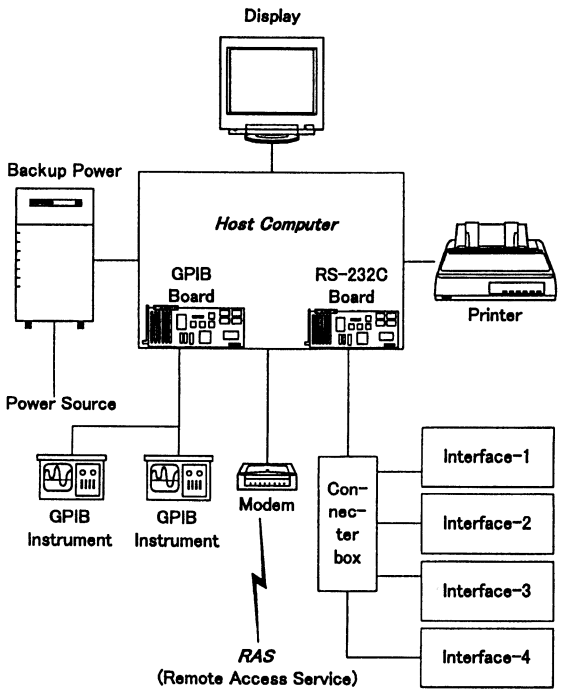

Fig. 2. Diagram of host PC connected to multiple interfaces of β-counting systems

Software

When the first BASIC programs for the β-counting system were developed (Omoto 1982), a single PC was used for each system. The main reasons were: 1) simplicity in controlling each system; 2) avoiding possible interruptions caused by controlling several systems by a single PC; and 3) the difficulty in purchasing affordable multi-tasking PCs. The earlier software programs and hardware systems had worked very well since their development in 1982. But, needless to say, a substantial amount of money can be saved by controlling a number of β-counting systems with a single PC. Then, with the development of Windows® 95 and Windows® NT, the possibility arose for using an operating system (OS) that provided multi-task capability and other useful functions. To take advantage of the capabilities of the new OS, the β-counting programs developed previously (Omoto 1982) had to be rewritten and supplemented. The programs were rewritten in Visual BASIC, and taking the opportunity to revise the programs, functions to allow the simultaneous control of several ^{14}C experiments were added.

Figure 3 shows the menu trees for the new programs. From the Start menu, any task necessary for ^{14}C dating can be selected. For example, if we want to execute a fully automatic β-counting experiment, we select (by mouse-clicking) job number 1 on the first menu. Then the system number from among our β-counting systems (system-1 through -4) will be selected. In the third menu, we input several primary data, *i.e.*, laboratory code number (NU-1234), operator name, time interval and total time for β-counting. Also, we must check the pressure and temperature of the filled counter, background and standard (NBS) values, primary high voltage for center and guard counters, and so on. Finally, the entire primary data on the display are checked and confirmed. Mistakes and incorrect data may be corrected at this time. After confirmation of the primary data, the plateau counting program may be started. After the system-l experiment has begun, an experiment with another counter can be started without any interruption to the first experiment. With multi-tasking, we are always able to stock carbon dioxide into a reservoir flask or purify it by using stock and purification equipment.

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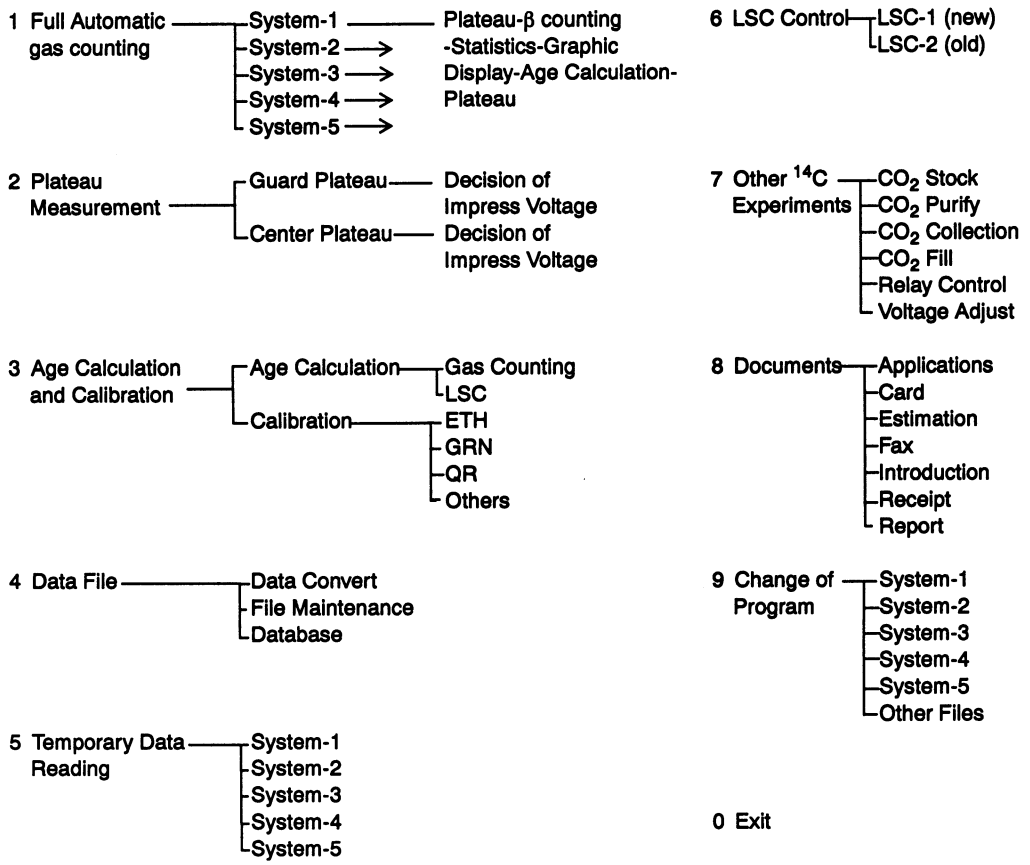

Fig. 3. Outline of menu trees for the new programs

When one system has finished or stopped due to an error, a decision must be made to continue or stop the experiment. The gas sample can be replaced by a new one to start another β-counting experiment. Based on this decision, a new file to execute the next job may be opened to control the CPU. It is also possible to execute other programs under the multi-task environment, such as writing an e-mail message or working with a document.

Results

In addition to the new hardware and software, the remote access system (RAS) is one of the most useful features of our Windows® NT workstation. We may now control our β-counting systems at any time, wherever we are. The β-counting systems can be monitored remotely by using a notebook-style PC, a modem, and a mobile phone (PHS). To do this, the host PC in the ^{14}C laboratory is called up by a mobile telephone that is connected to the notebook PC. The connection to the lab is made using the RAS and/or the Telnet function of Windows® 95 and Windows® NT workstation (Fig. 4). After the telephone connection has been established, the ID and password are exchanged between the notebook PC and the host PC. Then the host PC cuts off the line automatically, but soon the call-back system in the host PC starts, and a connection between the telephone line and the notebook-style PC is established. After the line is connected successfully, the β-counting systems may be controlled as if the operator were sitting in front of the β-counting system and/or display in the ^{14}C laboratory.

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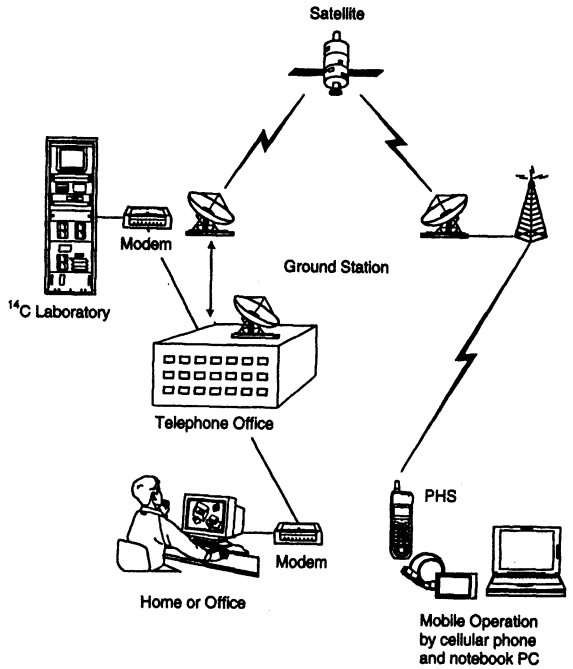

Fig. 4. Schematic diagram of remote access system (RAS)

Conclusion

The new hardware and software programs are working very well under the multi-task environment, and we are now able to remotely control four gas-counting systems with a single PC. Minor changes may be necessary to execute experiments faster and make them more complete. The system may be controlled more easily from outside our laboratory if we put new programs on the http server connected to the Internet. Several programs still have to be upgraded before we can connect the system to the Internet. It may be possible to similarly control liquid scintillation counting (Quantulus 1220™) if the I/O board and new software programs developed by Wallac Oy operate under Windows® 95 and Windows® NT workstations.

Acknowledgments

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[1]This list does not include the guidebooks and user's manuals for the new PC, peripheral instruments, or Visual BASIC.