INTRODUCTION OF COACK FOR THE MICROWAVE MONITOR SYSTEM IN THE KEK ELECTRON/POSITRON INJECTOR LINAC

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Abstract

The microwave monitor system, based on VXI/HP-UX, has been installed in the KEK electron/positron injector linac. It maintains stable operation of the linac. We are examining reinforcement of the monitor system to achieve upgrade of the linac for super KEKB project.

WE7000 was nominated substitute of the VXI-based DAQ system. The programming tool for WE7000 provided by YOKOGAWA enabled program development by VEE. VEE was employed in order to develop application program of the monitor system. Many program components will be used in an application for WE7000 effectively. Furthermore, introduction of COACK is discussed for a connection between the new DAQ system and GUI. COACK will also achieve combining of data measured by two kinds of DAQ systems.

1 INTRODUCTION

A microwave monitor system consisting of 30 VXI/HP-UX base DAQ systems and three servers is used in the injector linac[1]. Expansion of the monitor system is required in the linac reinforcement plan for the super KEKB project. However, we discuss introduction of a new DAQ system so that there is some restriction in a current VXI-based system. Some subjects should be solved in order to realize this plan. Management of the whole system becomes complicated so that two kinds of separated DAQ systems coexist. Since a microwave monitor is indispensable to the test run stage of reinforced linac, the development period must be short.

The solution that we discuss is introduction of a WE7000-based DAQ system and system management by COACK. The details of the plan are described in this paper.

2 AN OUTLINE OF THE MICROWAVE MONITOR SYSTEM

2.1 VXI-based DAQ system

The monitor system was designed in order to achieve stable operation of microwave source in 1995. The VXI-based DAQ system, which consisted of a built-in controller, a waveform digitizer and a DI/O module, was adopted to detect pulse-to-pulse event of a microwave source. High-speed data transfer between the controller and the digitizer by a shared memory protocol has achieved repetitive measurements of 25Hz. Currently 30 VXI-based DAQ systems are constantly monitoring 59 high-power microwave sources and 8 low-power microwave sources.

On the other hand, a disk-less configuration of the VXI controller was indispensable for eliminating any system failure caused by a hard-disk crash, because the DAQ systems were installed in noisy environment. The cluster architecture of HP-UX was employed to achieve our server and disk-less client configuration.
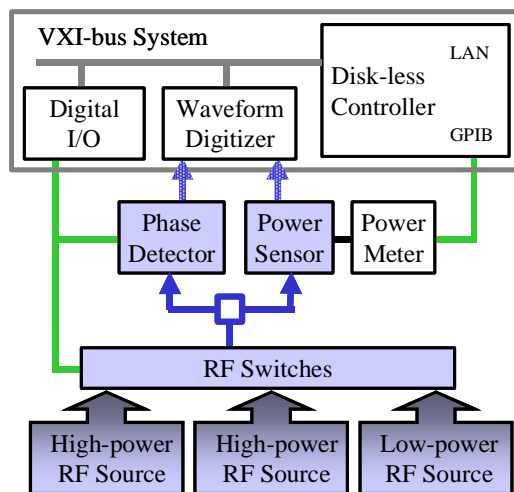

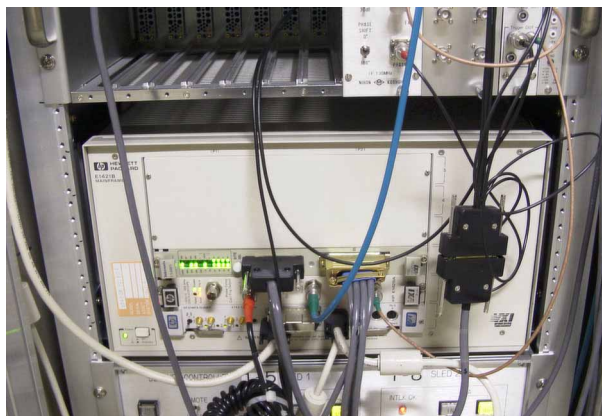Figure 1: A block diagram of the microwave monitor system

Figure 2: VXI-based DAQ system

2.2 Operation of the monitor system

The VXI base DAQ system has two operation modes of automatic measurement and remote control. The automatic measurement, that is a normal operation mode, acquires fixed time waveform data and saves calculated peak-power level and phase value to a server. The linac's operator can watch the trend of stored data by the browser.

On the other hand, the remote control mode provides measurement data to the operator in conjunction with GUI. The GUI has operability such as an oscilloscope.

3 A REINFORCEMENT PLAN OF THE MICROWAVE MONITOR SYSTEM

3.1 Microwave measuring instruments

Currently, a reinforcement plan of the injector linac for a SuperKEKB project is in progress. An upgrade of the linac will be achieved by changing a beam-acceleration frequency and adding more microwave sources. At downstream part of the positron generation target, beam-acceleration frequency is changed from 2856Mhz to 5712Mhz and high-power microwave sources will be increased from 24 to 48. A reinforcement plan of the microwave monitor system with upgrade of the injector linac is as follows. In order to cover frequency band of 5712MHz, a modification of microwave devices such as a peak-power sensor, a phase detector, a solid-state switch, is required. A microwave measurement system including a coaxial cable and accessories will be calibrated at 5712MHz.

3.2 DAQ System

The DAQ systems must be newly installed for a monitor of microwave sources additionally installed. However, since expansion of the current VXI-based system is difficult by the following reasons, we are discussing a new DAQ system seriously.

First, the system of the same construction cannot be increased because product of some modules was already discontinued. Next, there is a problem also in operating system. We are requested to continuously use of old HP-UX10.20 in order to maintain a disk-less configuration. A disk-less configuration is not supported in a new version after HP-UX11. Maintenance of the system will become difficult so that support of HP-UX10.20 is finished presently.

4 A DISCUSSION OF NEW DAQ SYSTEMS

4.1 Advantages of WE7000

Some devices have been nominated as a replacement of VXI-based DAQ system. WE7000 that is a PC-based measuring instrument produced by YOKOGAWA Co., Ltd. is suitable for our DAQ system. We consider the following advantages that WE7000 has.

The optical connection between a PC and a measuring station, which contain measuring instruments and I/O modules, realized high-speed data transfer and electromagnetic-noise protection. The electromagnetic-noise by the pulse power supply for high-power klystron often caused a problem to a device controller of the linac. Installation of PC to a safe place distant from a pulse power supply is effective in order to avoid a trouble. Moreover, Reduction of a cost by use of a general-purpose PC is possible. The VXI built-in controller was very expensive.

Figure 3: A sample of WE7000-based DAQ system

4.2 Program development by VEE

It is very important that program development by VEE is possible. As for the measurement program and GUI of the VXI-based DAQ system, most has been created by VEE/HP-UX. There is compatibility of source cord in VEE/Windows and VEE/HP-UX. If programming by VEE is possible, many components are diverted and a development period can be shortened.

As a programming tool for WE7000, API and the ActiveX control are provided by YOKOGAWA. Although those tools were not supporting VEE officially, we tried whether it could be used by VEE. As a result, control of WE7000 by VEE became possible by importing ActiveX control made in Visual Basic.
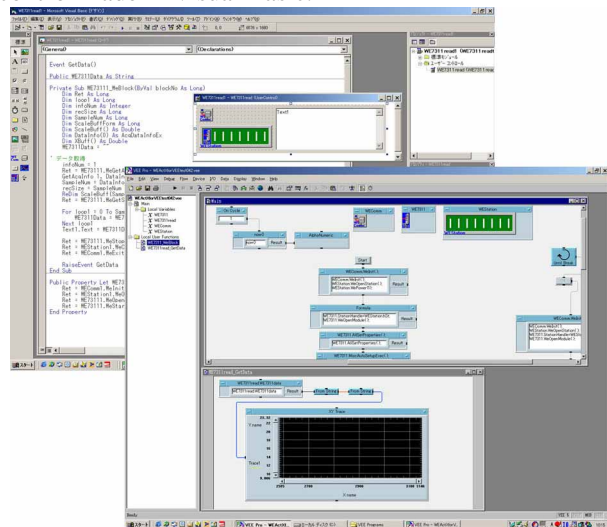

Figure 4: Importing customized ActiveX control to VEE

5 THE APPLICATION OF COACK TO THE MONITOR SYSTEM

5.1 Advantages by introduction of COACK

Establishment of the communication method between a new DAQ system and GUI is indispensable to operation of a monitor system. We consider effective solution of this subject by introducing COACK. COACK is a system to be located in between the user interface layer and the device interface layer, and it has the function that we required[2]. At an introduction phase of the current microwave monitor system, there was no standard communication method between GUI and IOC. Since the communication method needed to be developed uniquely, the many labor was spent on this work. Furthermore, expansion of a function of a monitor system is expected by introduction of COACK. For example, there is a case to adjust phase shifter of a microwave source so that the linac's operator cancels a detected phase transition. The alarm function that COACK has will be useful in order to automate this operation.
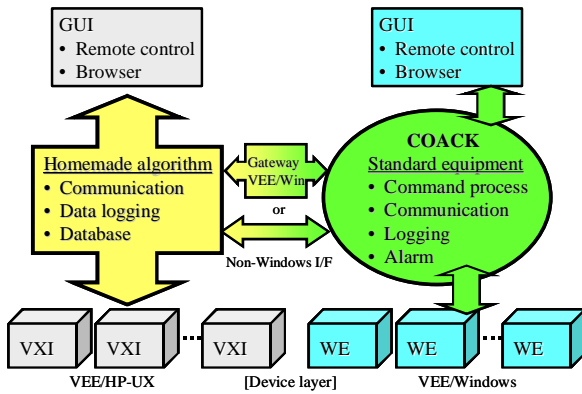

Figure 5:A concept of introduction COACK

5.2 Connection of VEE and COACK

When the WE7000 is adopted as a new DAQ system, the program development by VEE is planned. The connection between VEE for Windows and COACK has been tried since before. It is general to create a client application of COACK in Visual Basic. Importing the client ActiveX control created by Visual Basic attains connection with COACK.

A gateway program by VEE/Windows exchanges measurement data of a VXI-base DAQ system working in VEE/HP-UX. VXI-based DAQ system may be connected directly by using the Non-Windows interface that COACK has[3, 4]. If above-mentioned plan is achieved, measurement data by two kinds of DAQ systems are combined on COACK.
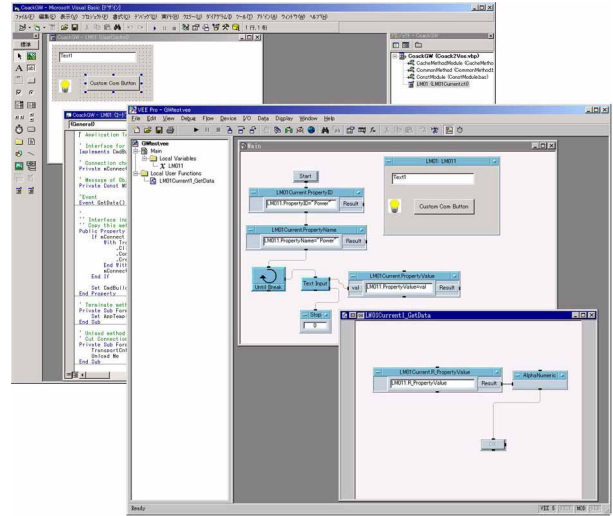

Figure 6:Coack client application by VEE

6 CONCLUSION

Construction of a new monitor system in short term is expected by introducing COACK. It was confirmed that WE7000 programming and COACK connection by VEE are possible. Development of a utility application for the new DAQ system is necessary in future.

Since introduction of COACK to a monitor field is a new trial, a new problem may occur. We cooperate with other COACK development members and try to discord it.

ACKNOWLEDGEMENT

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