Transactions of the Korean Nuclear Society Autumn Meeting
Busan, Korea, October 27-28, 2005

PEFP VACUUM CONTROL SYSTEM

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1. Introduction

.Development of a front end system for a high energy proton accelerator is in progress at Korea Atomic Energy Research Institute (KAERI) for basic science and industrial applications. The proper vacuum components has been installed and operated successfully between ion source and RFQ, DTL. The reliable operation of the accelerator has been completed at vacuum system in the high and ultra high vacuum range under operating conditions. Proper control system for the vacuum instruments, based on PC operated by Windows, has been designed and constructed by control group at PAL. As PC operated by windows with inherent instability does not proper, Windows OS had been replaced by Linux redhat9.0, and developed VME system for Dual Pump and NEG pump control.

2. PEFP VACUUM SYSTEM

2.1 Vacuum System Requirements

Vacuum instrumentation at front end includes valves, gauges, baking pumps, high vacuum pumps, ultra high vacuum pumps, and residual gas analyzers. The layout of vacuum system of front end is presented in Figure 1.

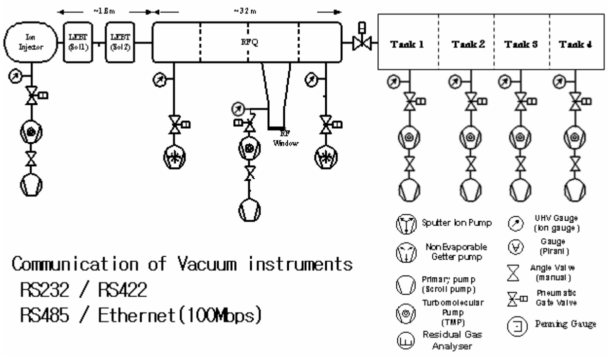

Figure 1. Lay out of vacuum system at front end.

All valves have both open and closed by 220VAC power with limit switch-type indicators. High and ultra high pumps have been used to maintain high vacuum in the machine. Remote serial communication had been used to turn on/off the pump high voltage and to read pump current, pressure, and voltage. Pirani gauges have been used to monitor the low vacuum levels from atmosphere to 10-4 Torr. The high vacuum levels within the accelerator, 10-3 to 10-10 Torr, will be measured using ion gauges. A multiple-gauge controller controls both Pirani gauges and ion gauges. Both pumps and gauge controllers provide interlock inputs to the vacuum controls. The residual gas analyzers will be used to characterize the residual gases in the vacuum to aid in determining the gas source such as a water leak, an air leak or component outgassing at DTL tanks [1].

2.2 Components for Vacuum Control

The vacuum control system of proton accelerator is constructed two kinds of IOC server system and interface. The Turbo Pumps and Gate Valves, Gauges of RFQ developed by PAL are constructed vacuum control system with serial interface (RS422), the Gauges and TMPs of DTL are constructed with Ethernet. The Linux OS is installed in IOC server of RFQ and DTL, PC component is presented in Table 1.

Table 1: IOC Server PC

Component	
CPU	Intel Pentium 4 2GHz
Memory	133MHz SDRAM 512Mbyte
Lan Card	PCI 100Mbps
PCI Slot	5
Hard Disk	IBM 36G SCSI-II RPM
Serial Port	RS422 24port

The control system of ion Pump and NEG Pump for DTL is constructed of VMEbus System. The VME system will be modified to construct control system of Power supply. VMEbus PowerPC component is presented in Table 2.

Table 2: IOC Server VMEbus PowerPC

Component	
CPU	MPC7410 400 MHz
Main Memory	PC 100 ECC SDRAM with 100 MHz
	Up to 512MB
Flash Memory	17MB on-board
I/O	Dual 10/100BaseT Ethernet

Target system of IOC server system is industrial pc and PowerPC, installed linux and vxWorks. The modules is base-3.14.6, asyn-4.1, ipac-2.8 [2]. The VME system modules compiled at the host pc (solaris) are operated at the target system, therefore The compiler is selected tornado 2.2.1 and gcc 3.1. The full vacuum system composes about 70 signals, pumps, and gauges. In the following Figure 2 shown vacuum control system architecture.

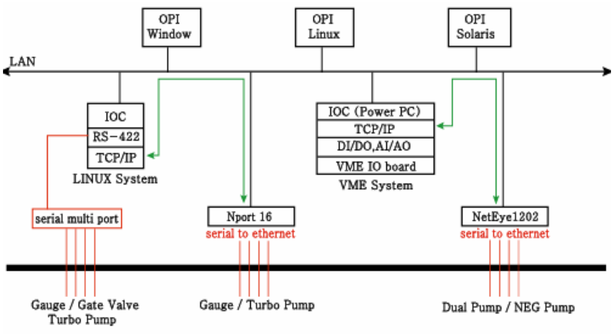

Figure 2. PEFP Vacuum Control System Architecture.

3. Vacuum Monitoring of EPICS based

Control systems of a accelerator are basically composed of Operator Interface (OPI), Input/Output Controller, and Local Area Network (LAN). The machine is mainly controlled by OPI and IOC, while LAN is the communication network which allows the OPI and IOC to communicate [3]. Various tools of both control objects can be provided by EPICS which was confirmed several facilities. Figure 3 is the picture of EPICS control system, based on PC, adopted at a portion of front end. Still the system on PC has no trouble in working; it is desirable to be replaced by VME platforms because other control

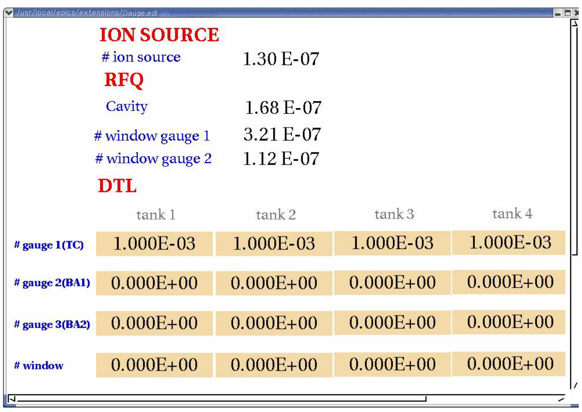

Figure 3. EPICS based vacuum control system

4. Conclusion

The vacuum instrumentation and control system based on VME at PEFP has been developed. A major effort on stabilization of vacuum system has been made with the aim of compatibility with the control systems of the other components. Integrated infrastructure for embedded system has been constructed by the porting vxWorks to VME system; embedded control system had been completed by modifying IOC drivers and OPI to be compatible to VME. After VMEbus System is confirmed of stability, the vacuum control system of PC base will be replaced with VMEbus system.

REFERENCES

[1] M. Y. Park, et al, Proceeding of the 2003 Particle Accelerator Conference, p. 2884, 2003.

[2] http://www.aps.anl.gov/epics/index.php

[3] J. H. Kim, el al, Proceeding of the 8th International Conference on Accelerator & Large Experimental Physics Control systems, p.128, 2001.