A.7: EPICS Based Control System for Microtron

The control software for Microtron was recently upgraded by Accelerator Control section. The Labview based control software has now been replaced by EPICS based control software. Experimental Physics and Industrial Control System (EPICS) is a set of open source software tools and applications that provide a software infrastructure for building distributed control systems, and is used worldwide to operate devices such as Particle Accelerators, Large Experiments and major Telescopes. EPICS use Client/Server and Publish/Subscribe techniques to communicate between the various computers. The servers (called Input/Output Controllers or IOCs) perform real-world I/O and local control tasks, and publish this information to clients (Operator Interfaces or OPIs) using the Channel Access (CA) network protocol. CA is specially designed for the kind of high bandwidth, soft real-time networking applications. The home-grown VME infrastructure at RRCAT, along with LabVIEW was used earlier for the Microtron. Increasing demands and continuous evolution of the system entailed upgrade of the control system. The new system offers better SCADA performance, is easily scalable for future high performance requirements and offers possibility of efficient communication across various controllers in a uniform, distributed system to enable feedback systems in future.

There are about 150 parameters (Process Variables or PVs) of the system to be administered by EPICS. The lowest layer consists of equipment controller, a VME station (consisting of Motorola 68K CPU, ADC, DAC, Relay and Opto in boards), acquisition devices such as Oscilloscope, Teslameter and temperature scanner and other instruments like RF synthesizer. The VME CPU runs an assembly program that handles standardized commands for interfacing with VME I/O boards. Other devices are handled by the standard manufacturer specified control commands. The middle layer is the Input-Output Controller (IOC). It is a Linux PC running Ubuntu 8.10 that links to the lowest layer instruments and acquisition devices on RS-232 and TCP/IP. The IOC was framed on EPICS base version 3.14.9. The record support was built using base 3.14.9. The IOC is used to process the raw data and publish it in the form of PVs to be used by the EPICS clients. The error checking modules and event based processing of data have been incorporated in IOC. The upper layer is the Operator Interface; it is a Linux PC running Ubuntu 8.10 that runs CA clients (Fig. A.7.1) designed in EDM 1-11-0z. The OPI connects to the IOC on 10 MBPS Ethernet on Channel Access protocol. It shows the readback status of power supplies, interlocks, temperatures, vacuum, magnetic field etc, and control widgets for analog setting and ON/OFF control of devices. Other functionalities for user authentication, default settings, cycling of magnet, device status and help were also provided.

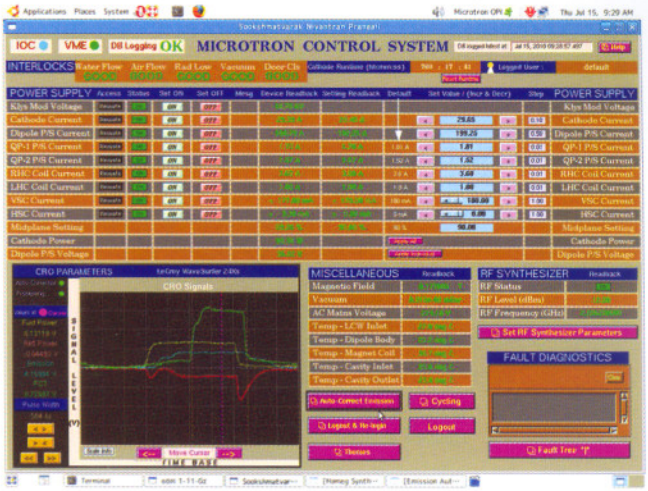

Fig. A.7.1: The Microtron Control GUI developed in EPICS

A fault diagnostic module and emission auto-correction was also provided. The offline fault diagnosis module predicts anomalies in the system behavior and eases fault troubleshooting. The cathode emission auto-correction is a closed loop control for controlling electron emission from the cathode. The alarm handling consists of reporting the alarms at the user interface and trip alarm calculation and generation at the IOC database. The data logging is done and data is logged in the central Microsoft SQL Server based database.

Employing EPICS proves beneficial than commercial SCADA. The EPICS IOC servers can talk to each other and can access each other's PVs over Ethernet. Hence, future expansion to other systems will make the whole system integrated. EPICS has modular architecture. As EPICS is free and open source, it provides a cost effective upgrade on control software. A huge community support is available for EPICS.

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A.8: Indus-1 Beamlines Gate Valve Authorisation system

The Gate valve authorization system was recently commissioned by Accelerator Control Section in Indus control room. This system is employed to give permission for opening gate valve GV0 to beam line users. GV0 is the valve isolating Indus-1 ring from a Beam line. The authorization is given from control room. This was done to implement this procedure in a coordinated manner and avoid accidental venting of the ring on opening GV0, in case the beam line vacuum level is not appropriate. Also, the control room will have full information,