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COMPUTERIZED CONTROL AND DIAGNOSTICS OF CYCLOTRONS

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ABSTRACT

The modernizations of the control of various subsystems of the Cyclotrons have been done at Variable Energy Cyclotron Centre (VECC), Kolkata. The distributed control of Cyclotron demands a robust, reliable control system to satisfy the monitoring and control criteria of a good number of machine parameters. Following specific guideline, control for several sub-systems of the cyclotrons including power supply, RF, cryogenic, vacuum, ion source position, deflector, low conductivity water cooling and beam diagnostics are developed. The architecture and realization of the development of the control systems are elaborated in the presentation.Thehardware/software for distributed control and beam diagnostics implementation is described here.

The hardware of the control system is implemented in a two-layer architecture with PC's /Workstations /PLCs /Controllers connected through a Gigabit Ethernet optical fibre LAN.

ABSTRACT

The front-end computers (FEC) are industrial PC's communicating through peer-to-peer/multi-drop serial bus or GPIB with device controllers and instruments. Commercial data acquisition and control modules equipped with serial connectivity are used in cases of distributed I/O control and data acquisition. Plug-in PC modules are used in cases of parallel transfer needed in shorter distance and for faster communications.

The EPICS (Experimental Physics & Industrial Control System) architecture is adopted to design the supervisory control software. The EPICS implementation is facilitated by the use of different EPICS tools. PLC with integrated Modbus-TCP connectivity is used with accessories for analog/digital input/output signals. The control systems are programmed to detect multi-level failures.An EPICS tool is developed to integrate the EPICS control /monitoring system with database. This tool provides several facilities to the user e.g. secured access, auto-configuration and web based interface with data analyzing and retrieval facility. A storage area network (SAN) system is commissioned to ensure on-line availability of operational parameters of the Cyclotrons at Office network and keeps the control LANs physically isolated from the office LAN.

Important beam parameters e.g. shape and size of the beam, beam current, position of the beam, deviation of the beam from the median plane and turn separation are measured. Various probes and application specific modules /instruments are developed for beam diagnostics. The positioning of the diagnostics probes and measuring of beam current impinging on the probes are done with very high precision and accuracy. The challenges faced,are the precise micro-positioning of the probes and measuring of very small current (order of nano-ampere) submerged under high noisy environment.