A.10: Linac-3 control system

The indigenous development of 9.5 MeV electron linear accelerator, named Linac-3, targeted for food irradiation is in progress. A linear accelerator (linac) for the radiation processing facility requires various subsystems and auxiliary support systems for its operation. The control system for Linac-3 is designed to provide Supervisory Control and Data Acquisition (SCADA) functions for various linac sub-systems.

Linac-3 control system functions:

A. Data acquisition and monitoring of machine parameters with 12-bits precision at 1Hz.
B. Machine parameters settings.
C. Data logging of machine parameters at 1Hz.
D. Display of plant parameters.
E. Interlocks for safe operation.

Linac-3 control system architecture: The control system is based on two layered, modular and distributed architecture. Layer-1, the User Interface (UI) layer, consists of LabVIEW based applications. Layer-2, the Equipment Interface (EI) Layer comprises of VME Equipment Control Station (ECS), master trigger unit, radiation monitors, search and scram system, various instruments and devices like DSOs, RF synthesizer, power supplies, vacuum pump controllers etc. The control system is interfaced with various sub-systems through digital / analog / RS485 / Ethernet interface.

General description of system: Control system is comprised of two main components, the hardware and the software. The hardware component describes the physical interconnection of various signals from the front-ends, their interfacing, processing in electronic hardware up to the transfer of the signal information to the user interface layer. The software component describes the acquisition, monitoring, processing and control of plant parameters.

Hardware description: ECS has VME Equipment Controller (EC), signal isolation and termination system and safety interlock modules. The EC has a VME CPU board and multiple VME I/O boards. The subsystems are connected to the control system via ECS through digital input/output (~400) and analog input/output (~100) signals. Some devices are interfaced to PC over data communication links viz. RS232- 1 link, RS485 - 2 links and Ethernet - 9 links. Data link converters are also used.

Software description: Software is designed to operate and supervise the machine. Figure A.10.1 shows the control system architecture. The main functions include acquisition, analysis, data storage and presentation. LabVIEW based Graphical User Interface (GUI) runs on the console PC in the control room. The VME EC is based on Real Time Operating System (RTOS) software. Approximately 10 different types of communication protocols are handled to operate devices from centralized control system. The GUI, database server and web server facilitate operation and data presentation. An overall data refresh rate better than 1 sec is maintained. Figure A.10.2 shows the main GUI panel of Linac-3 control system.

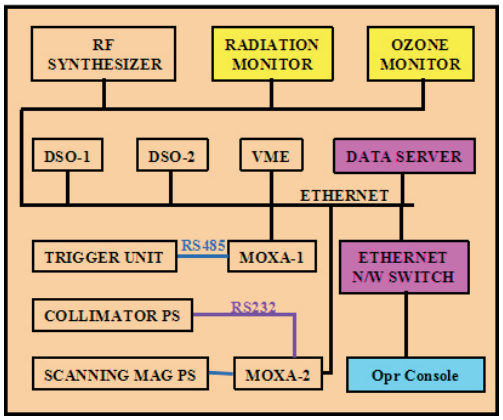

Fig. A.10.1: Linac control system architecture.

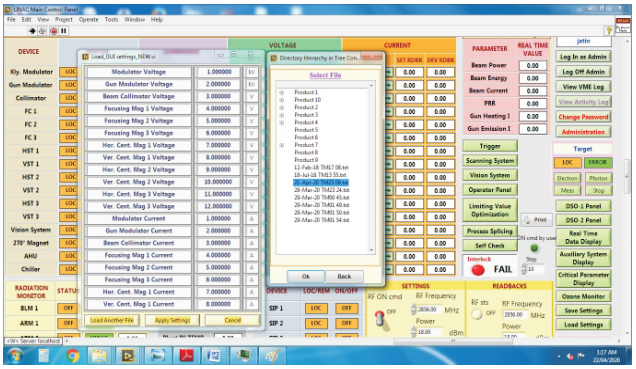

Fig. A.10.2: Main GUI panel of Linac-3 control system.

Machine Safety Interlock System: Operation of the linac facility is associated with the industrial and radiation hazards. Operation with a number of safe conditions, referred as interlocks, is implemented to ensure the safety of the personnel and machine. An independent hardware interlock system is implemented. Some of the subsystems have few local interlocks whereas most of the global interlocks are processed in the interlock system.

The control system of Linac-3 has been commissioned and is in regular use for carrying out various trials and studies.

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