A.5: Implementation of new control system of Microtron for Indus complex

For upgradation of control system for Microtron, a new control system has been designed by Accelerator Control Section. The new system is designed to deal with issues viz large cable load, EMI problems, multiple types of interfaces, component obsolescence etc. faced with present control system and to realize the benefits of the upgraded system.

Architecture: The control system is based on a two-layer distributed hardware architecture scheme, as shown in Fig A.5.1, in which each of the subsystems is controlled by dedicated logic modules implemented in Xilinx Spartan3 FPGA (XC3S400-4PQ208) and few support chips. All the hardware is designed and developed in-house. The control modules are named as Equipment Control Module (ECM). This constitutes the front end instrumentation or Equipment Interface (EI) layer or layer-2. Each ECM controls two power supplies. All the ECMs in the field are sitting on an RS485 serial bus and communicate with the User Interface (UI) layer or Layer-1. Ethernet to Serial converter device is used for the communication between Layer1 and layer-2. The UI layer consists of WINCCOA SCADA server running the Application Program Interface(API) manager and the Graphical User Interface(GUI) over a switched network.

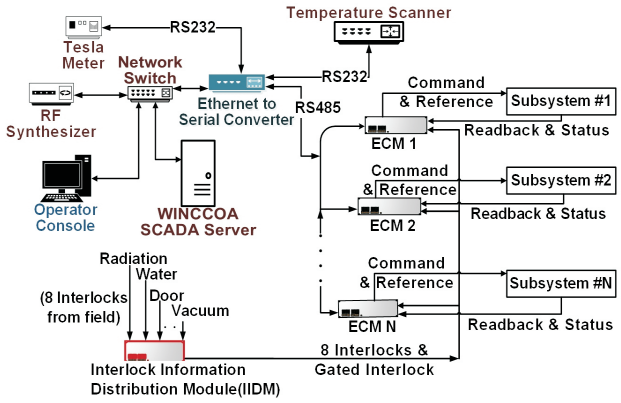

Fig. A.5.1: Architecture of new Control system of Microtron

Interlocks: Various interlocks information from all over the field is collected in a central Interlock Information Distribution Module (IIDM), which in-turn sends the interlock signals to all the ECMs over the interlock bus. Each ECM inputs the interlocks, isolates and reads them. Actions on interlock failure are governed by equations implemented locally in the hardware of the respective interlock receiver card on ECM.

Testing and deployment: IIDM and ECMs are installed and connected with the subsystems of Microtron. Cables for communication, and interlock bus are laid for connection between ECMs and distribution of interlocks signals from IIDM respectively. All functional testing of each of the ECMs was also carried out with actual subsystems connected. Finally, the Microtron was operated for a beam trial.

Fig A.5.2 shows the GUI panel for upgraded system. The testing was done with UI layer for various functionalities like control & monitoring of different power supplies, cycling etc. Communication interfaces for DSO, RF synthesizer, teslameter & temperature scanner are also tested.

Results: Stable electron beam of approximately 14 mA was obtained in TL-1. Fig. A.5.3 shows waveforms captured on the DSO during the test trial.

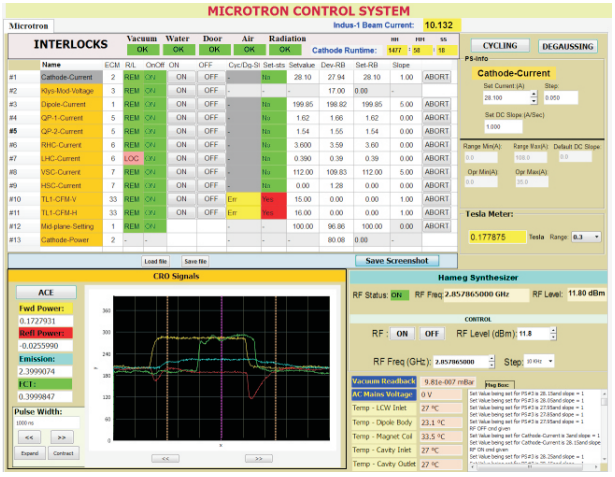

Fig. A.5.2: GUI for new Control system designed in WINCCOA SCADA

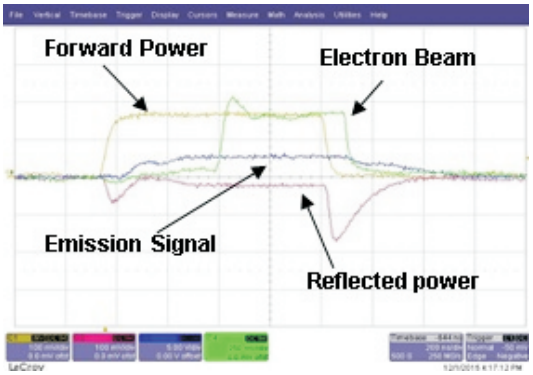

Fig. A.5.3: Various parameter waveforms on DSO

The control system is deployed on December 23, 2015 and since then the Microtron is operated with this control system.

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