A.10: Development and commissioning of two 65kW capacity precision chillers for the Indus-2 RF cavities with DAQ upgradation work

The Indus-2 RF cavity body requires a dedicated demineralised (DM) precision water-cooling system. Any change in temperature causes corresponding change in cavity body size, indirectly changing its frequency and harmonics. The proper operation of the accelerator requires precise synchronization of the cavity frequency. Two cooling loops are being operated by Coolant System Lab (CSL) to fulfil these requirements. The HOM coupler and bracket assembly are being cooled by main LCW cooling loop with temperature stability of $\pm1.0^{\circ}$C and RF cavity body needs precision cooling with temperature stability of $\pm0.1^{\circ}$C. The reported development work is for the improvement in operational reliability of Indus-2 by installing two new chiller units and hydraulic manifold with arrangement at site in chorological schedule without affecting the operation. Now we have five chillers in operation for four RF cavities.

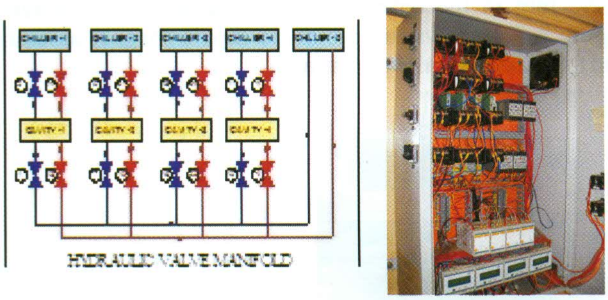

Fig. A.10.1 (a) Hydraulic manifold(left), (b)Signal selector box(right)

Signal selection box: All the reference temperature signals from the cavities are installed in a selector box with silver contact multiplexing switch. Correct cavity temperature reference signal is connected to the chiller by using a selector switch box and no physical changeover of sensor is required. These are the improvements based on our past experience. We have achieved a great reduction in chiller shutdown time and ultimately RF cavity operation.

Table A.10.1: Main specifications

Cabity Flow Rate	13 $m^3\ h^{-1}$
Supply Pressure	10 kg cm^{-2}
Supply Temperature Range	25-80^{0}C
Cavity Cooling Capacity	65 kW

Controls and software: The chillers run unattended round the clock during Indus-2 operation cycle, hence a DAQ system was necessary to continuously monitor the system and log the data. The DAQ system along with an alarming system has been installed. There are safety interlocks which trip the particular device or whole system if any critical problem appears.

Fig. A.10.2: DAQ system and chiller panel

All the alarm and trip signals appear on alarm annunciator as well as on computer screen. This is a server-client based system and remote monitoring is possible from control room. We can also see history data for the analysis and fault finding purpose.

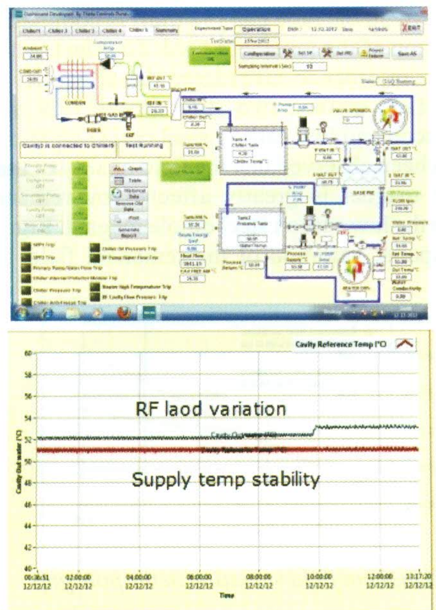

Fig. A.10.3:Mimic screen and supply temp stability

Temperature control: The plate heat exchanger and three-way control valve mechanism provides the precision chilling loop and maintain the process water tank temperature near the set value. The microprocessor controlled heating system refines the pipeline thermal losses. The fast-response direct-immersion RTD temperature sensor has been installed just at the inlet header of cavity body, which provides feedback signal to PID controller. The supply water temperature stability (repeatability) of $\pm0.1^{\circ}$C is achieved by the use of precision and active control system with a tightly constrained proportional, integral, derivative control loop.

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