Fig.A.6.1 : Beam Line Front Ends GUI Panel with BL-21 Front End Controls Integrated.

Protection of ring vacuum is ensured by gate valves, designated GV0s, located at the periphery of Indus-2 ring. These GV0s separate the machine vacuum envelope from those of the beamlines. These are installed at the beginning of beamline front ends (BLFE). These pneumatic gate valves allow remote control and status monitoring through their controllers.

Front end controls for beam line 21 of Indus-2 were integrated with the main machine controls. All such interlocks and permission mechanisms were checked by a team of persons from control, vacuum and front end instrumentation groups. All related operations were declared operational from main control room.

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A.7: New Power Supplies for Transport Line-2 Quadrupole Magnets in INDUS

Existing power supplies for quadrupole magnets in TL-2 are based on 6-pulse controlled rectifier and are being continuously used for past several years. These are being replaced with new, compact, efficient and stable power supplies. New, high stability, dc current controlled power supplies of rating 25 V, 80 A have been developed at PSIAD to energize quadrupole magnets in Transport Line-2 (TL-2) of INDUS. They are developed using two switch forward converter topology operating at 50 kHz because of their distinctive merits such as smaller size, lighter weight, better efficiency, simple configuration, free from shoot through failure, no requirement of demagnetizing winding, high reliability and ruggedness. Input to the power supplies is 415 V, 50 Hz ac while the output voltage and current ratings are 25 V and 80 A respectively. Specified stability of output current is ±1000 ppm.

Special arrangements have been made during assembly of components to ensure accessibility to failure-prone components for easy maintenance and replacement. Twisted wires have been used for interconnections to minimize stray inductances. The heat dissipation of losses in power devices is transferred through a water cooled heat sink. Wiring has been minimized by using easy pull-out cards with interconnections on the mother board, providing push buttons, test points and LEDs on fascia plate of the cards. In the front end of the dc stage, an in-rush current limit network is incorporated to suppress high surge current during start-up. Each power supply is capable of being operated from local fascia panel or in remote mode from central computer interface via a 25-pin sub-D connector provided on the fascia plate. Various protections like output dc over current, input over current, over temperature of power devices and loss of cooling water flow have been incorporated in design to protect the power supply in case of occurrence of these faults.

Each power supply is housed in a 4U, 19-inch rack as shown in Fig. A.7.1 and they have undergone various tests like:

- Open loop test to check the basic functionality of the power supply.
- Closed loop test to check the stability of control loop.
- Local/Remote operation test which included testing of all the command, status and analog signals both in local as well as in remote mode.
- Heat run test in which power supply is operated continuously for 10 hrs at full rated power output for 5 days.
- Stability test to measure the stability of output current and ensure that it is within specified limits.
- EMI test to measure conducted EMI and ensure that it is as per CISPR-11 standards.

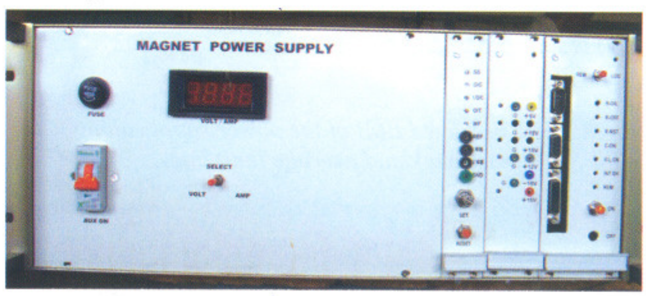

Fig. A.71: Front view of power supply.

Long term stability of output current was tested to be well within the specified limits. Figure A.3.2 shows the stability curve for 8.5 hrs of continuous operation of power supply after initial warm-up time of 1.5 hrs. Following steps were taken to achieve the required stability:

- A stable shunt made of zeranin is used in the feedback network.
- OP07 precision OPAMPs are used in reference, feedback and error amplifiers.
- Stable MFR resistors are used in reference, feedback and error amplifiers.

Conducted electromagnetic interference (EMI) was measured and pre-compliance was achieved with CISPR-11 norms as shown in Fig. A.3.3.

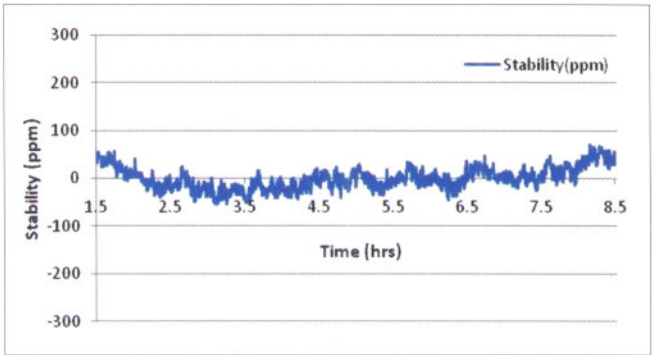

Fig.A.7.2: Output current stability of power supply

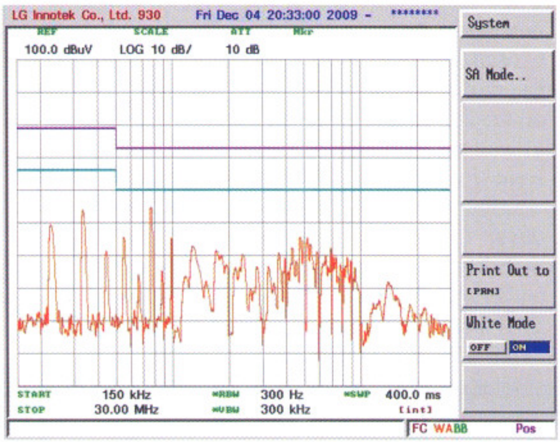

Fig.A.7.3: Conducted EMI of the power supply along with CISPR-11 quasi-peak and average limit lines.

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A.8: Further testing of 1.3 GHz Single cell SCRF cavities

Two numbers of 1.3 GHz prototype Single cell Superconducting Radiofrequency (SCRF) cavities have been successfully developed processed and tested under IIFC collaboration (RRCAT newsletter - article A.3, vol.23 issue2, 2010). The single cell SCRF cavity TE1CAT002, which was tested to achieve 21 MV/m in the first run was further processed and tested at Fermilab, USA.

The internal optical inspection of the cavities has revealed certain irregularities in the inner equator weld at few locations. In order to polish it, the cavity was processed using Centrifugal Barrel Polishing (CBP). A total of 140 μm at Equator and 40 μm at iris were removed in cumulative four processed steps. The cavity was then subjected to heat treatment under vacuum (800°C for 6 Hrs) to expel out the hydrogen. This followed the light electro-polishing 20 μm, high pressure rinsing (80 bar for 6 Hrs) and low temperature baking at 120°C for 48 Hrs. The cavity was tested at 2 K in Vertical Test Stand (VTS) as shown in Fig.A.8.1.

Fig.A.8.1: The single cell SCRF cavities mounted in VTS for 2K test at FNAL.

The cavity was quench limited to maximum gradient of 23 MV/m. Multipacting was observed at 19 MV/m, and the cavity experienced several quenches due to this multipacting, at gradients between 19.1-19.4 MV/m. As a consequence of these quenches, the cavity's Q values decreased somewhat, presumably as a result of trapped magnetic flux. There was no field emission observed at any time, but some minor radiation