High frequency switch-mode circuits are not used to develop the current sources since requirements of fast transient response and wide setting range of output current conflict. Instead, MOSFET operating in linear mode is used. However, a two-switch forward converter operating at 100 kHz is used at the front-end for AC-DC step-down conversion with output voltage regulation and input power-factor-correction. A microprocessor – controlled front panel and RS232 interface provides individual control of each parameter while the backlit LCD display provides visual confirmation of operating parameters. Various faults are also displayed on the front panel. A user- selectable slow-start function allows configuring the slow-start current ramp. Connections to the laser diode are made through a coaxial cable to reduce stray inductance.

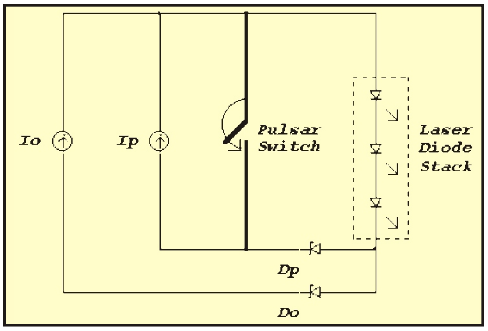
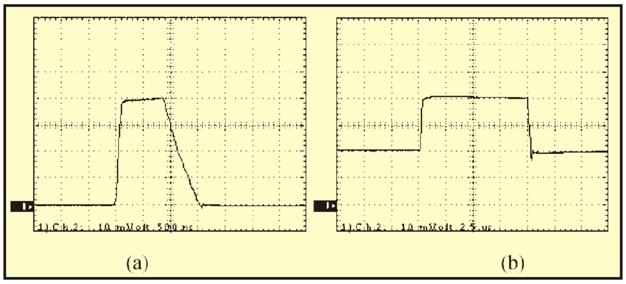


Fig.A.4.1 *A circuit diagram showing principle of operation of the laser diode driver*

Fig.A.4.2 A *photograph of laser diode driver*



(a) (b)

Fig.A.4.3 *Typical output current waveforms of the laser diode driver. (a) 1 µs pulse of 4 A (1 A/div, 500 ns/div) (b) 10 µs pulse of 2 A with 2 A bias current (1 A/div, 2.5 µs/div)*

Fig.A.4.2 shows the photograph of the laser diode driver. Typical output current waveforms are shown in Fig.A.4.3. A relatively high fall-time of current observed is due to the extended length of one of the load connections, to insert current probe for measurement.

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A.5 Treatment of Electroplating Effluent by Ion Exchange Method

Chemical Treatment Laboratory takes up around 6,000 components of accelerators and lasers every year for Chemical cleaning, electroplating and surface modifications. The processing generates huge amount of liquid waste, which contains many heavy metal and non-metal ions. Untreated disposal of waste poses threat not only to aquatic life but also to human beings. Heavy metals can cause different types of cancers, problems related to central nervous and cardio vascular systems. A lab study with suitable ion-exchangers was initiated in the year 1997 to replace the chemical precipitation method for the treatment and safe disposal of toxic electroplating wastes. Based on the lab studies and results, a pilot treatment plant has been installed. The entire set up contains two pairs of FRP columns having capacity to accommodate 65 liters of ion exchangers in each of them. First pair contains strong cationic exchanger, which is capable of removing all polyvalent cations (Nickel, Copper, Iron, Zinc and Aluminum) present in the waste. Another pair contains strong anionic exchanger that removes anions (Chloride, Sulphate, Phosphate and Nitrate) from the effluent. The combined treatment makes the waste free from all hazardous contaminants (as per ASTM & IS). Columns heights are designed and split on the basis of minimum retention time for complete exchange.

Analyses for ionic impurities are being carried out by a double beam UV-Vis- Spectrophotometer, specific ion electrodes and volumetric methods. By this treatment process, the metallic and non metallic ions are reduced by more than thousand times. In some cases the concentrations after treatment are below detectable limits (BDL). The electrolytic conductivity of the plating waste falls nearly to the raw water level. Hence, steps are being planned to feed this treated effluent into the demineralization unit, so that demineralised water thus produced can be reused. In this situation, no waste will be disposed to the ecosystem (Zero discharge). This will reduce the water consumption for electroplating activities to a greater extent.

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A.6 Electron Gun Test Setup for Indus-2 crotch assemblies

High power density absorbers called crotches are used to absorb the radiations in dipole chambers of Synchrotron Radiation Sources. The power density to be absorbed, ranges from 800 to 1000 W/cm2. These crotches are tested with an alternate power source, simulating identical power density in UHV environment. A test setup (fig.A.6.2) including electron gun has been developed to test the crotch assemblies of Indus-2. For these crotches, the beam size required is 150 mm x 5 mm having a power of 5 kW. A pierce type electron gun has been designed and fabricated to simulate the required test conditions. The crotch assembly has been assembled with the gun and the gun has been coupled with the power supply. Testing of the first crotch assembly is in progress. Table lists the specifications of the electron gun. We have achieved a power level of about 3 kW with the first crotch assembled with the gun. This test was carried out to assess the radiation level around the test area. As suggested by health physics experts, further tests will be carried out after providing lead shielding around the gun and crotch assembly. simulate the required test conditions. The crotch assembly has been assembled with the gun and the gun has been coupled with the power supply. Testing of the first crotch assembly is in progress. Table 2 lists the specifications of the electron gun. We have achieved a power level of about 3 kW with the first crotch assembled with the gun. This test was carried out to assess the radiation level around the test area. As suggested by health physics experts, further tests will be carried out after providing lead shielding around the gun and crotch assembly.

Table 2 Specifications of Electron Gun

Type of gun	Modified pierce gun
Gun rating	60 kV, 100 mA
Mode of heating	Direct
Material of filament	Thoriated tungsten of diameter 0.5 mm
Length of filament	54 mm
Beam size at the crotch	Rectangular beam size 150 mm x 5 mm
Perveance	0.02 μP

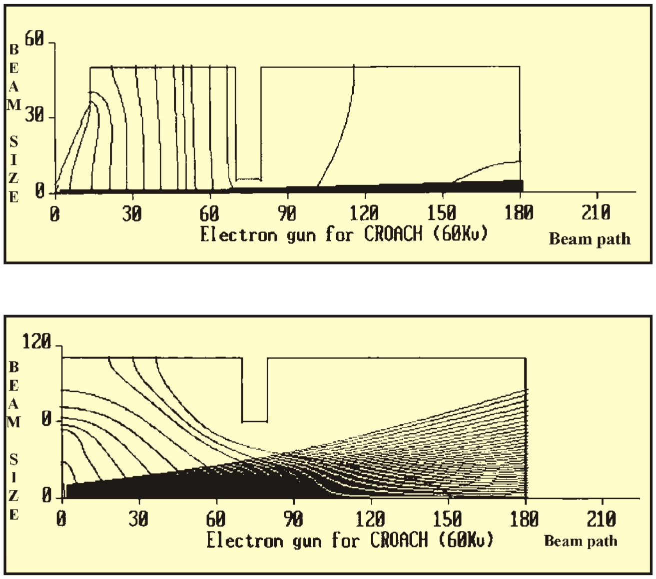

***Fig.A.6.1** Simulated beam trajectories for the crotch gun using EGUN*

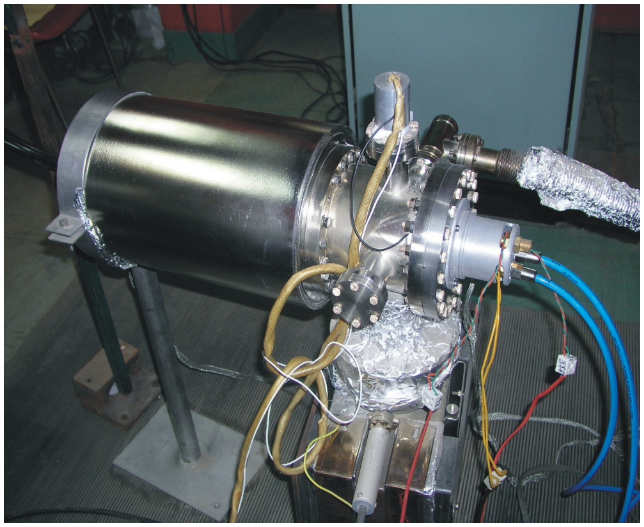

***Fig.A.6.2** Test setup for crotch assembly*

The design parameters were simulated and optimized using SLAC-EGUN code for electron gun. The beam size is optimized in the transverse plane. Fig. A.6.1 shows the simulated trajectories for the crotch gun and Fig. A.6.2 shows the test setup.

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