A.8: Development of collimator magnet power supplies for 10 MeV ARPF Linac

Collimator coil, which is placed at the exit of the electron gun of 10 MeV ARPF Linac, plays a very crucial role in creating a correct magnetic field for injecting a proper beam into the RF accelerating cavity. The electron beam is highly sensitive to the collimator field, so a very accurate and highly stable field control is required. This in turn demands a very stable (less than 500 ppm) current controlled power supply with a very high resolution current setting of 1 mA for the collimator coil current (Table A.8.1). Two numbers of such supplies were successfully developed and tested for its required performance and one of the power supplies was installed and commissioned.

Table A.8.1: Brief specifications of the power supply

Sr.	Parameter	Specification
1	Output Voltage	10 V
2	Output Current	0-2 A
3	Resolution	≤ 1 mA
4	Type	Current Controlled
5	Stability	± 100 ppm *
6	Ac input	230 V AC ± 10 %, 50 Hz
7	Protections	Over voltage, Over current and Short-circuit
8	Remote operation	Analog programming

* : w.r.t. to rated output current during 8 hrs after 1 hr warm up

The power supply is designed in two stages. The first stage of the power supply is a switch-mode isolated ac to dc power converter with fixed regulated output voltage. To achieve 1 mA resolution with accuracy better than 0.05% of output current, a current controlled linear regulator is used in the second stage.

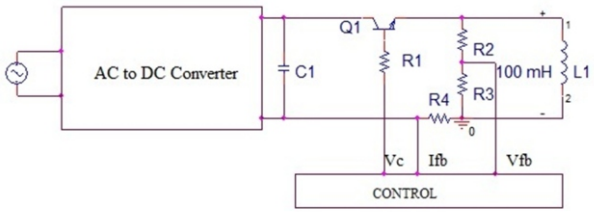

Fig. A.8.1: Schematic of collimator power supply

The power supplies were designed, simulated and prototyped. After successful development of a prototype table top power supply, two numbers of such power supplies were developed. The schematic of the power supply scheme is shown in Fig. A.8.1. The power supply is assembled on a 4U card with front facia as shown in Fig. A.8.2. The power supply can be operated from remote through analog programming. It has all standard protection features and is short circuit proof.

Power supply has been tested in local mode for 24 hrs for heat run test. Output current stability better than ±100 ppm was achieved using power supply internal reference in local mode operation. The shunt resistor of Powertron make FPR series was used for current sense with TCR of ±25 ppm/K.

Fig. A.8.2: Photograph of developed power supplies

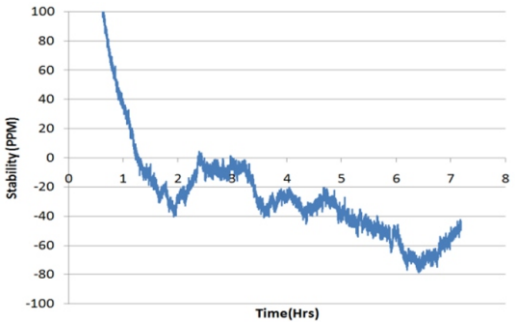

Fig. A.8.3: Long term stability after 1 hour warm up (<100 ppm)

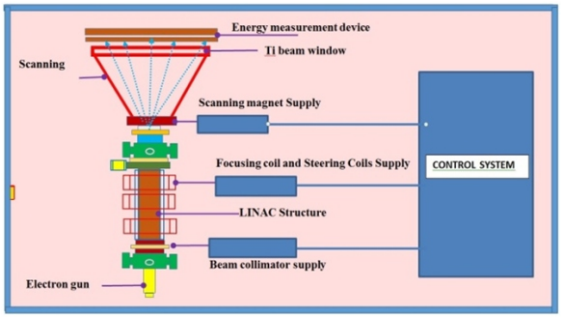

Fig. A.8.4: Basic block diagram of ARPF Linac showing location of collimator coil and supply

A typical long term stability measurement result is shown in Fig. A.8.3. The basic diagram of 10 MeV ARPF Linac with collimator and other magnets is shown in Fig. A.8.4.

Reported by:
Vishnu Gauttam(vishnuk@rrcat.gov.in) and Apollo Kasliwal