

### A.9: Linac-3 development

Development of high power linac for food irradiation applications using electron beam is being pursued at RRCAT. The maximum energy of electron beam for this application must be limited to 10 MeV in electron mode of operation as per the regulatory requirements. Development of Linac-3 for a beam energy 9.5 MeV and beam power of 10 kW is being pursued to meet these objectives. Two new features have been added in Linac-3 as compared to Linac-2 design (Linac-2 is operating at Agricultural Radiation Processing Facility, Indore). The first new feature is a pre-buncher RF cavity which is used to inject bunched electrons into the linac, thereby improving the electron transmission efficiency and reducing the energy spread of accelerated electrons to a reasonably low value of  $\pm 5\%$  for 90% particles (Figure A.9.1). The second new feature is a maximum electron energy limiting system. This is used to limit the maximum electron energy within regulatory limits. Linac assembly with energy limiting system is shown in Figure A.9.2.

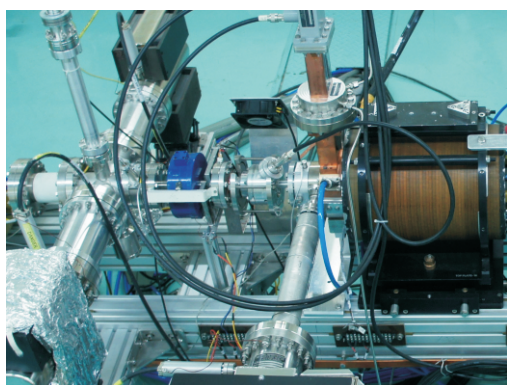


Fig. A.9.1: Linac-3 pre-buncher RF cavity.

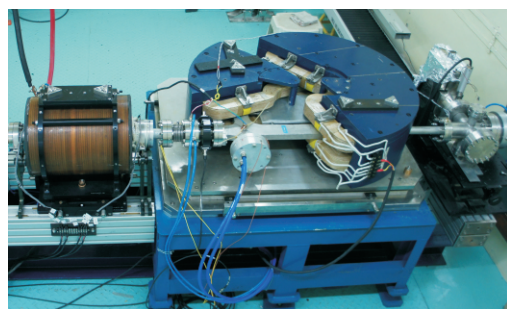


Fig. A.9.2: Linac-3 electron energy limiting system with 270° magnet. Beam focusing solenoid is also seen on the left.

The energy limiting system consists of a doubly achromatic 270° magnet, vacuum chamber and a beam scraper. The water cooled beam scraper made of Al alloy 6061 – T6 is provided at an angular distance of 180° from the location of beam entry into the magnet. The electrons with energy more than

regulatory limit are stopped by the scraper and not allowed to pass onto the product being irradiated. Figure A.9.3 show the photographs of magnet, chamber and scraper.

Beam trial of Linac-3 was carried out up to 5 kW at 9.27 MeV energy without energy limiting system to verify endurance and power handling capability of various systems. Thereafter, the energy limiting system was installed and beam trial up to 1 kW was carried out at beam energy of 9.5 MeV as shown in Figure A.9.4. Beam current transmitted through the energy filtering system was 310 mA and linac was operated up to 50 Hz pulse repetition rate (PRR).

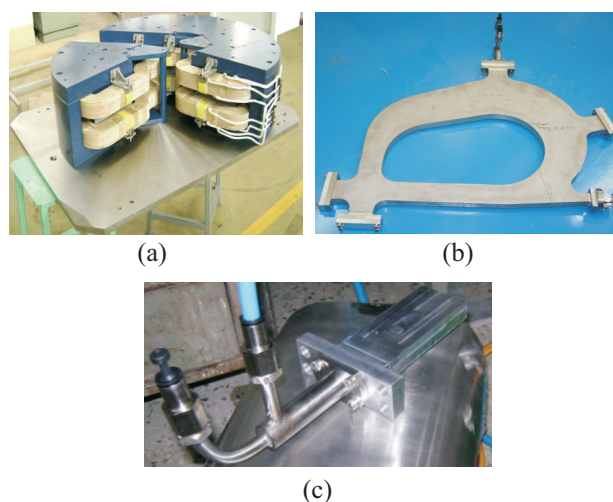


Fig. A.9.3: Important components of energy filtering system, namely, (a) 270° magnet, (b) chamber and (c) scraper.

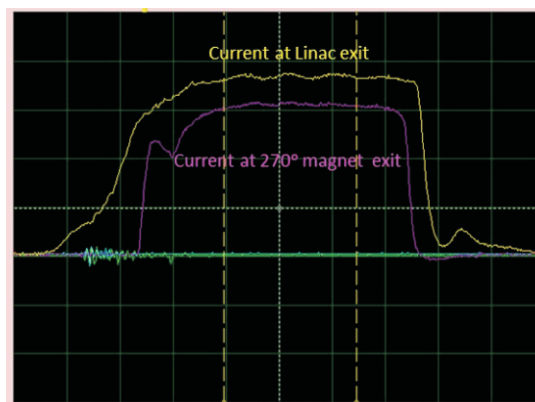


Fig. A.9.4: Beam trials up to 1 kW with energy filtering system. Vertical scale: 100 mA/div. Horizontal scale: 2  $\mu$ s/div.

Improvements in electron gun as well as energy filtering system are under progress to progressively increase the beam power.

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