

TO AND FRO CONVEYOR SYSTEM FOR LESS IRRADIATION DOSE APPLICATIONS USING 10 MEV LINAC FACILITY

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Abstract

The minimum radiation dose, from 10MeV Linac irradiation facility, is 21kGy at a conveyor speed of 100mm per minute and at 450mm below from titanium exit window. The 100mm per minute is the minimum speed that can be achieved with existing toe line type, induction motor based conveyor system. Total thirty two trolleys are installed in the existing conveyor system and it takes around forty minutes for a trolley to come again below the scan horn when the gap in between the trolleys are covered at a speed of 5m/min. Thus for any small package say even 100 kg of Rice husk, when installed in a

and maximum speed of 06m/min. A stepper motor (160kg-cm) based conveyor system has been designed, installed and being used for all small dose and small sample size irradiations using 10 MeV Linac facility at EBC Kharghar as shown in Figure1. The limit switches installed at two ends of the conveyor trolley sense the forward and reverse movement requirement. These limit switches are adjustable on a sliding rod and its positions are adjusted according to the job requirement, so that beam is utilized efficiently. The micro-controller based stepper motor controller is installed in the control room,



Figure 1: To and Fro Conveyor System, showing radiation tray filled with polyethylene gaskets to be irradiated, also seen the limit switches, the stepper motor below the trolley, the scan horn of Linac and water cooling lines of scan horn

trolley and if it has to be given 400 kGy, around 800 minutes of machine operation is required even if the beam is kept off when the particular trolley is not under the scan horn. The existing toe line conveyor can move only in the forward direction. Thus it was felt that a small conveyor system should be designed and installed, which can move a weight up to 150 kg and can be moved in forward and reverse direction even at a minimum speed of 05 mm/min

from where the speed of movement and the number of cycles can be entered for the operation. In case of power failure or forced stop this controller remembers its previous settings and it can start from previous position, or from fresh, depending upon the command given by the user. This paper describes about this modular and compact to and fro trolley based conveyor system.

Dose Profile of 10MeV Accelerator*

Beam Energy=10MeV, Peak Beam Current=100mA, PRF=300Hz,

Average Beam Power=3kW

Scan Frequency=1Hz and scan length=1000mm

**Dose measured at 450mm from exit window*

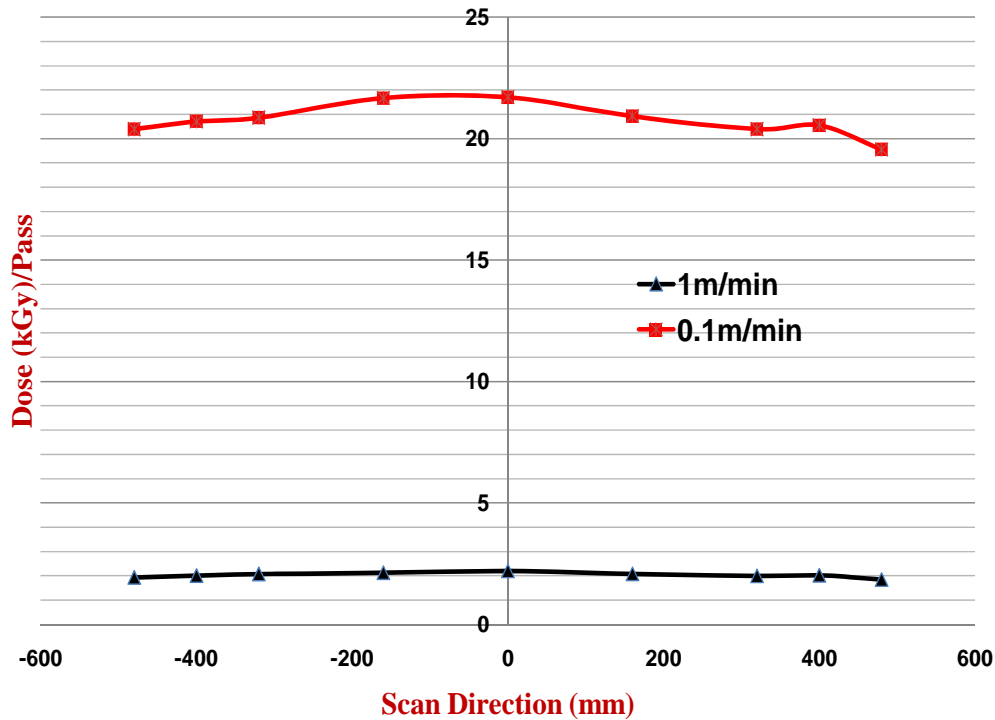


Figure 2: Dose Profile of the RF Linac

DOSE PROFILE OF 10 MeV RF LINAC

Figure 2 shows the dose profile of RF Linac, at 03 kW beam power and different speed of conveyor at a distance of 450 mm from exit window. Thus for irradiating the samples more than 20 kGy in a single pass, speed has to be reduced below 100 mm per minute. The installed to and fro conveyor system has been tested up to a minimum speed of 02 mm per minute reliably.

BEAM UTILIZATION

We have optimized the tray size shown in the figure-1 such that sample to be irradiated is just below beam and limit switches are adjusted in such a way that the moment tray touches the limit switch of say forward movement side, the tray has crossed the titanium foil window and the

reverse side movement starts, thus no beam wastage happens during the irradiation of samples or products.

INSTALLATION

This small trolley type conveyor system is easily installed in between the gap of two trolleys of existing toe type conveyor system. This is easily removed from the conveyor line, when main conveyor system is to be run.

CONCLUSION

A stepper motor based modular, small trolley with tray movement in forward and reverse direction on rollers, conveyor system using micro-controller for controlling the speed and direction is very useful for small irradiation dose applications and sample testing. We have carried out gasket irradiation and few biological samples irradiation using this to and fro movement conveyor system.