ALTERNATIVE DESIGN OF A TARGET CHANGER FOR RADIONUCLIDE PRODUCTION

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A compact target changer assembly was designed and fabricated to remotely position four (4) different targets horizontally on the external beam line. The system design may be useful at other facilities that wish to modify the cyclotron facilities for the production of PET radiopharmaceuticals. The assembly was fabricated on-site using 70 hours of machine shop time and a cost of <$1000 for the components.

1 Introduction

Institutions with positive ion cyclotrons are interested to make improvements that facilitate operations that are not encountered with contemporary commercial cyclotrons. A system for remotely changing targets mounted on the external beam line was not provided by the Cyclotron Corporation. Several different types of target changing devices have been described that either position the targets mounted on a rotating barrel; or an assembly the moves targets into position on the beam line by vertical translation. The literature designs were bulky or not readily adaptable to our facility. We had limited floor space, and required a compact target changer assembly that remotely moves 4 targets horizontally to the beam line. We fabricated a system that uses a gear operating to position each target to preset locations, while the target holder plate is displaced from the mounting plate. When the target was positioned, the mechanical assembly was pressed by compressed air to seal against the o-rings of the beam line mounting plate. The target changer was designed for targets used production for PET radionuclides (e.g., ^{11}C, ^{13}N, ^{15}O, ^{18}F, or ^{38}K).

2 Design and Assembly

Photographs 1 - 4 illustrate the constructions of the mounting plate and the target holder plate. Photo 3 depicts the gear that was made in-house. Photo 5 presents the appearance of overall assembly of the target changer. The overall length of the assembly is 55 cm. The component used include: one each Molon, QGM 4029-5 Hi-HIPOTTED 2100 VAC motor; one each Nova I, Model N2-SC solenoid valve; three each Skinner EO8, B2DA1400, 400 psi, 1/32 valve; one each Skinner IC5, P53ADB2150, 150 psi, 3/64 and 1/16 valve; and three each Skinner EE8, B2DA1175, 175 psi, 1/16 valve. The assembly was fabricated on-site 70 hours of machine shop time and a cost of <$1000 for components.

3 Overview

The King Faisal Specialist Hospital and Research Center commissioned the CS-30 cyclotron in 1978 [1]. Over the years a number of modifications to the CS-30 have been reported [2].

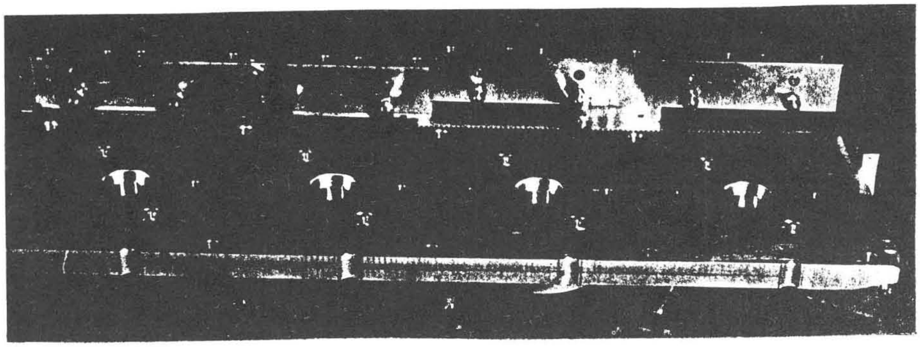
The CS-30 has been used primarily for:

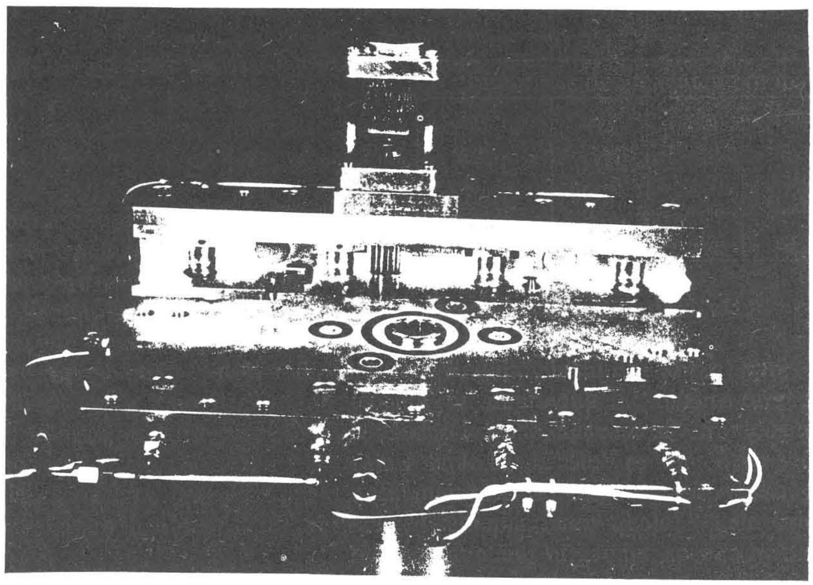
* Radioisotope development, e.g. iodine-124 [3],
* Radiopharmaceutical manufacture, e.g. thallium-201, gallium-67, iodine-123, indium-111 and rubidium-81 / krypton-81m generators,
* PET radioisotopes and radiopharmaceuticals, e.g. ^{18}FDG and ^{13}N-Ammonia, and
* Medical physics, radiobiology and neutron therapy [4].

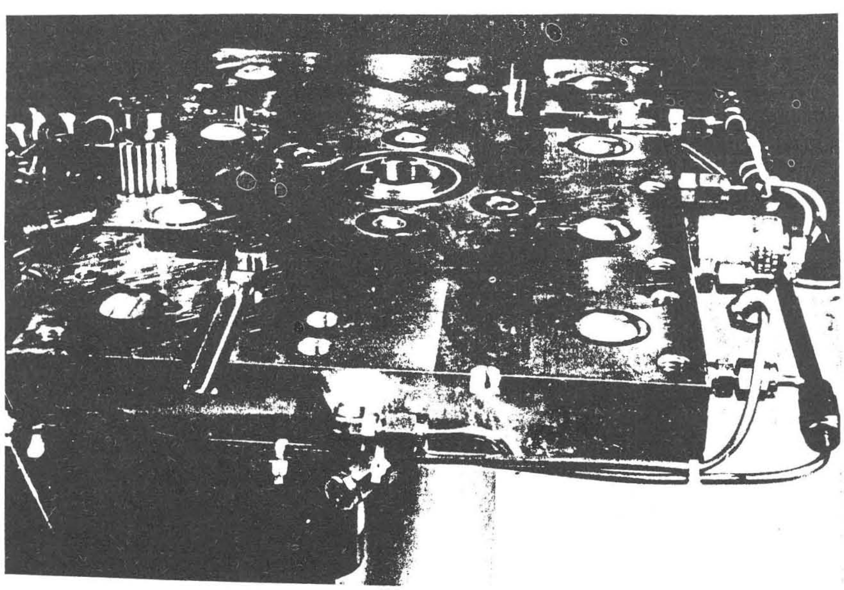
Radiopharmaceuticals have been distributed for clinical nuclear medicine use at 14 different hospitals in the Kingdom of Saudi Arabia; 1 hospital in Qatar; and 1 center in West Asia. The initiative to distribute iodine-124 ($T_{1/2}$ = 4.16 d, β^+, 25%) for PET radiopharmaceuticals included distribution of the labelling grade radiochemical to the Sloan Kettering Memorial Cancer Center, University of Pennsylvania, The National Institutes of Health, UCLA and Mass General Hospital in the USA; Hammersmith Hospital and the Royal Marsden Cancer Center in the UK; and the Medizinisch Hochschule Hannover, Germany was interrupted in 1990. Both nuclear reactions, the $^{124}Te(d,2n)^{124}I$ with 15 MeV deuterons and the $^{124}Te(p,n)^{124}I$ with 13 MeV protons were used.

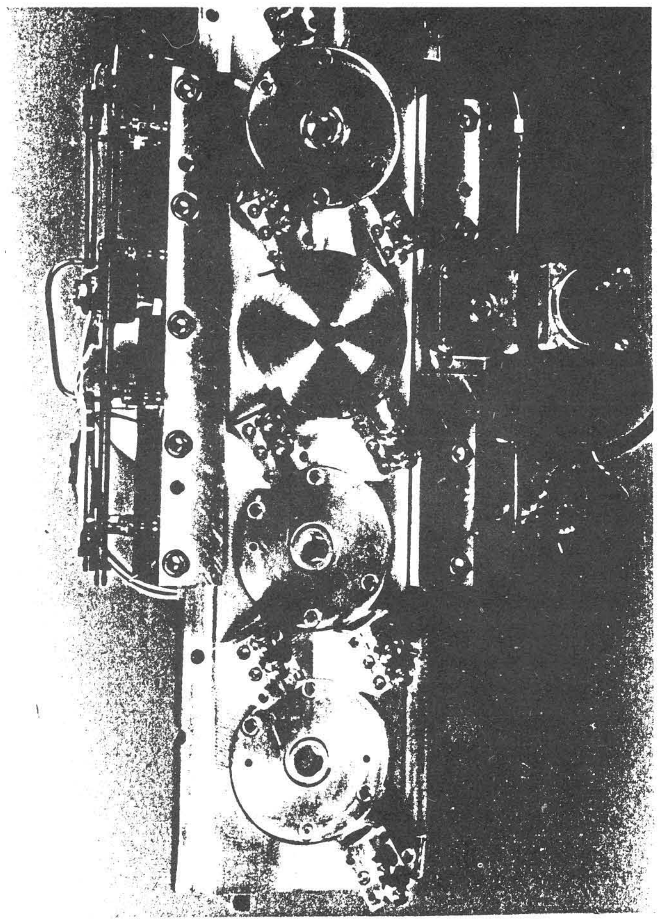
The cyclotron has only been used to accelerate protons since 1991.

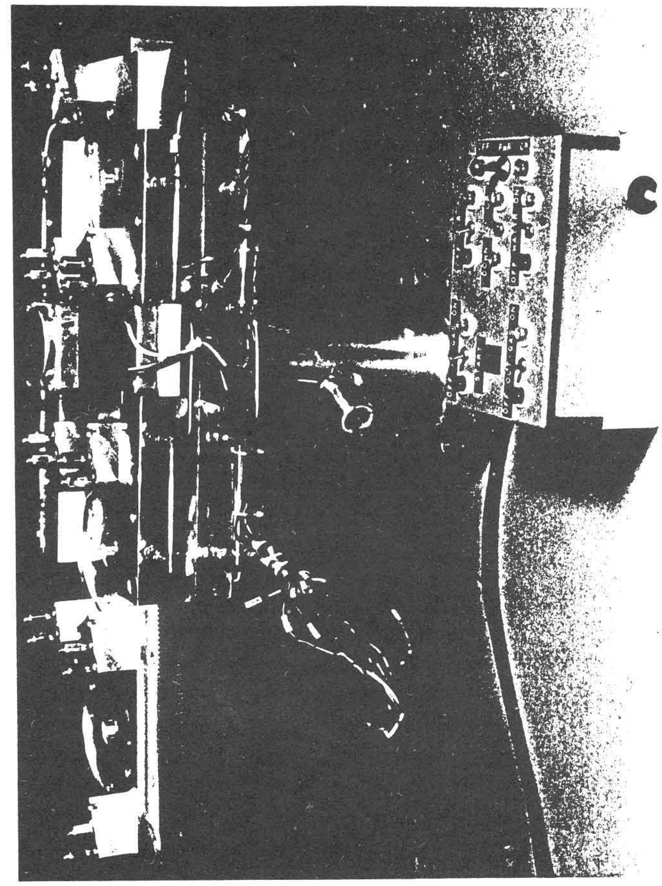
Further information was recently reported in the Directory of Cyclotrons [5].











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References

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