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Short Research Article

A study on a tandem target for a simultaneous production of C-11 and F-18†

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Introduction

C-11 and F-18 are the most commonly produced positron emitting radio nuclides at hospitals and they are useful isotopes for the development of radiopharmaceuticals for imaging tumours with positron emission tomography (PET). It is necessary to construct two individual target systems to produce C-11 and F-18.

A simultaneous production of different radioisotopes[1] has become of interest to facilitate the development of radiopharmaceuticals, and hence a tandem target system for a simultaneous production of C-11 and F-18 has been studied[2].

Two factors in the design and manufacture of a tandem target system are as follows; first, the target should endure a pressure difference during a bombardment; second, the proton beam should be effectively absorbed with a minimal energy loss on each target material. We employed a transmission grid to satisfy these two considerations. Schlyer *et al.*[3] reported the effectiveness of a thin target window supported by a transmission grid which is known to be useful for a lower energy irradiation with higher beam currents and can withstand beam currents more than 100 μA of protons and deuterons. The calculation of the energy loss was done with the SRIM code[4] with a 30 MeV incident proton beam. The incident energy on the gas target was 13.9 and 7 MeV on the water target.

Here, we would like to report the design and manufacture of a tandem target for a simultaneous production of C-11 and F-18.

Results and discussion

The tandem target system is composed of three parts (Figure 1); an energy degrader and a front water cooling, a gas target for C-11 production and a liquid target for an F-18 production. The proton energy for the gas target was 14–8 MeV and the liquid target was 7–0 MeV.

Energy degrader had a coolant path to dissipate the heat generated a during proton beam irradiation (see Figure 2). The shape of the gas target was conical by considering a beam broadening. The liquid target had two thin titanium foils (50 μm) in addition to two

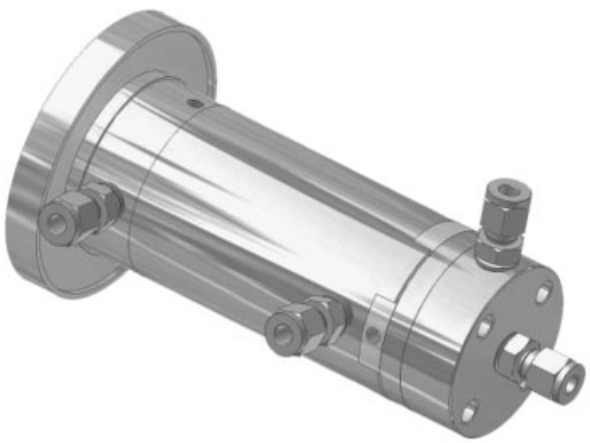

Figure 1 3D design of the tandem target.

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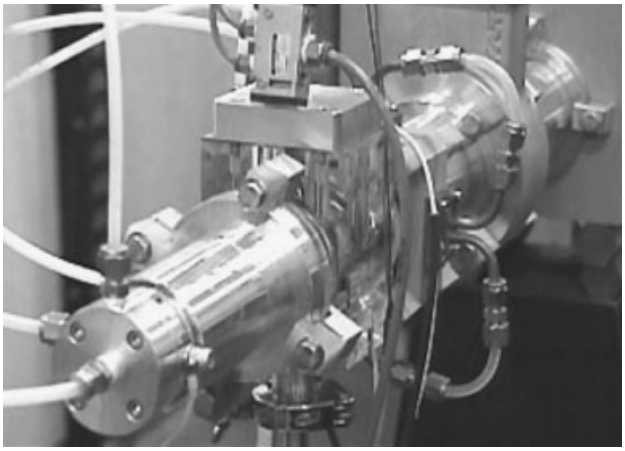

Figure 2 Tandem target installed at the beam line.

supporting grids. Al-2063 was used for the degrader and gas target chamber material and pure titanium were used for the liquid target and window foils.

The target was tested at 20 μA and the beam current was monitored with a collimator. The variation of the target pressure was monitored through the pressure transducers (Table 1).

Table 1 Target pressure variation during a bombardment (bar)

Beam current (μA)	Loading	5	10	13	15	20
Pressure (C-11)	12.8	14.2	14.8	15.0	15.4	15.8
Pressure (F-18)	11	12.0	12.8	13.1	13.3	13.7

It was confirmed that C-11 and F-18 (ca. 10 GBq order) can be produced simultaneously with a 30 min (20 μA) bombardment from this study.

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