Abstract 049

Evaluation on metallic Sc as target for the production of ^{44}Ti on high energy protons

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Radionuclide generators provide an alternative and often more convenient source of radionuclides compared to the direct production routes at accelerators and nuclear reactors. Especially generator produced positron emitters are of increased interest for development of novel PET-radiopharmaceuticals [1]. Thus $^{68}Ge/^{68}Ga$ radionuclide generator is successfully introduced into the clinical PET for routine production of ^{68}Ga-PET tracers. Due to rather short half-life ($T_{½}$ 68 min) ^{68}Ga is useful, however, only for the investigations on fast *in vivo* processes.

With 3.97 h half-life and 94.27 % positron branching ^{44}Sc is a very attractive alternative for applications in clinical PET. The major advantage is the production possibility of this radionuclide *via* $^{44}Ti/^{44}Sc$ radionuclide generator (^{44}Ti $T_{½}$ = 60.0 y). The limited availability of the long-lived mother nuclide ^{44}Ti complicates further development in the radionuclide generator technique and ^{44}Sc-radiolabelled compounds.

^{44}Ti can be produced by the $^{45}Sc(p,2n)$ nuclear reaction. The long half-life of the accumulating nuclide and a low cross section (Fig. 1) result in a very low production rates and long-term high-current irradiations must be performed. The irradiation facility at Paul Scherrer Institute provides up to 72 MeV and 70 µA proton beam. For the production of ^{44}Ti we are evaluating massive metallic ^{45}Sc targets for the long-term irradiation with protons up to 40 MeV. Up to 10 mm thick scandium blocks are encapsulated in an electron-beam welded thin Al-foil. For the possible routine production the water-cooled target system is supposed to withstand up to 7000 µAh resulting in 50 – 100 MBq of ^{44}Ti. In this respect, the preliminary results on the irradiation yields and optimizations as well as stability of the system are presented.

[1] Rösch, F., Knapp, F. F. Radionuclide Generators. In: Vértes, A., Nagy, S., Klencsár, Z. Handbook of Nuclear Chemistry. Amsterdam, 2003; 4: 81 – 118;

[2] Experimental Nuclear Reaction Data (EXFOR) http://www-nds.iaea.org/exfor/exfor.htm

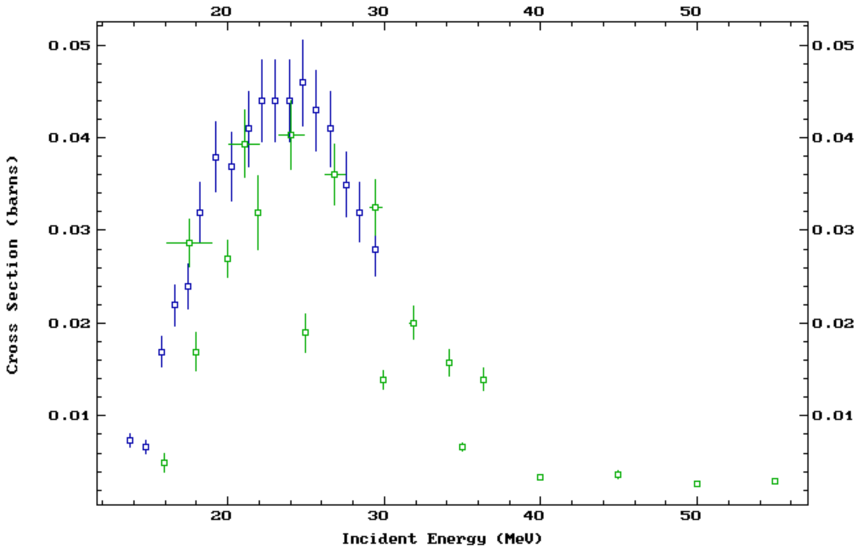

Figure 1. Excitation function of $^{45}Sc(p,2n)^{44}Ti$ reaction [2]