cross section of about 620 mbarn at 16 MeV. About 128 MBq ^{43}Sc can be produced per microamp and hour in the optimum energy range of 16 → 5 MeV providing radionuclidic purity of >99%.

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127
Production of Lu-177 in the BR2 high-flux reactor

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The BR2 reactor is a 100 MWth High-Flux 'Materials Testing Reactor' operated by the Belgian Nuclear Research Centre, SCK•CEN. The availability of high neutron fluxes up to 10^{15} n cm^{-2} s^{-1} allows the routine production of various radioisotopes for nuclear medicine (Mo-99/Tc-99m, Ir-192, Sr-89, Sm-153, Re-186, Lu-177, W-188/Re-188, Y-90, Sn-117m, etc.). In particular, lutetium-177 is a very attractive therapeutic radionuclide (β^-; $E_{max} = 497$ keV; $T_{1/2} = 6.7$ d) which as well emits low energetic gamma rays (208 keV and 113 keV) for imaging. Lu-177 is produced in excellent radionuclidic purity and with high specific activity by two alternative production routes in the BR2 reactor. The direct route ^{176}Lu (n,γ) ^{177}Lu consists in the irradiation of highly enriched Lu-176 targets, while the indirect route ^{176}Yb (n,γ) ^{177}Yb → ^{177}Lu is characterized by the irradiation of highly enriched Yb-176 targets, followed by a sophisticated radiochemical separation process of Lu-177 from Yb isotopes. The advantage of the indirect method is to produce carrier-free Lu-177 without the long-lived impurity Lu-177m ($T_{1/2} = 160$ d). The irradiation conditions of the highly enriched target materials have been optimized to produce Lu-177 of high specific activity. The results achieved in the BR2 reactor for both production routes will be discussed.

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128
^{99m}Tc production by proton beams irradiation: new excitation functions measurement

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^{99m}Tc is the most used radiotracer in nuclear medicine. This is due to multiple advantages, not only from a physical and chemical point of view but also because it is conveniently available through a ^{99}Mo/^{99m}Tc generator system.

In recent years there was a worldwide shortage of ^{99}Mo/^{99m}Tc produced via fission of highly enriched uranium target in nuclear reactors and there is an increasing interest in verifying the cyclotron production of ^{99m}Tc via the nuclear reaction ^{100}Mo(p,2n)^{99m}Tc.

Proton-induced nuclear reactions for generation of ^{99}Mo and ^{99m}Tc radionuclides were investigated using the stacked-foil activation technique on 99.05% enriched molybdenum in ^{100}Mo targets at energies up to $E_p = 21$ MeV. Excitation functions of the reactions ^{100}Mo(p,x)^{99}Mo and ^{100}Mo(p,2n)^{99m}Tc have been measured.

The first measurement of the samples was generally started few hours after the end of bombardment depending on the activity of the targets and measurements continued periodically for about one month to follow the decay of molybdenum-99.

The thin-target yields have been plotted as a function of their average energy into the thin target and the best mathematical functions were fitted. These mathematical functions were integrated to gain the calculated thick-target yields: the direct production of ^{99m}Tc using the ^{100}Mo(p,2n)-reaction on highly enriched molybdenum in ^{100}Mo appears to be promising, however the production would solve only local or regional problems.

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129
PET imaging using titanium-45: Could it be useful?

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In the last decade a wider application of positron emission tomography (PET) as one of the most powerful medical imaging technologies was observed. This was largely due to the increased availability of equipment dedicated to production of radioisotopes, mainly due to the installation of low energy cyclotrons in hospitals, research institutes and pharmaceutical industries specialized in radiopharmaceutical production.

While many radioisotopes are known and virtually all of them may be artificially produced in nuclear reactors, cyclotrons or radionuclide generators, only a very small number is useful for medical applications. Indeed, clinical applications of PET imaging are mainly based on fluorine-18, carbon-11, nitrogen-13 and gallium-68.

This trend could eventually change in the near future with the use of other radioisotopes, with distinct physico-chemical properties, such as metallic radioisotopes.

A potential candidate is titanium-45, with its interesting properties: its physical half-life (3,09 h) is sufficiently large to facilitate industrial exploitation, including its distribution to medical centers which lacks production *in situ*, while the remaining physical characteristics ensure good image quality. Its chemical properties enable radiolabeling with several bifunctional chelates, ligands or could even be useful for studies concerning the distribution of new titanium-based chemotherapy drugs or titanium oxide nanoparticles (eventually allowing theranostic approaches?).

This paper aims to describe the most important properties of titanium-45 and refer some considerations and challenges concerning production and application.

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130
Accelerator based ^{99}Mo/^{99m}Tc production activity in Armenia

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Experimental investigations were done for obtaining ^{99m}Tc by irradiation of $^{nat}MoO_3$ using high-intensity bremsstrahlung photons from the electron beam of the LUE50 linear electron accelerator located at Yerevan Physics Institute (YerPhI). The high value of the specific activity of ^{99m}Tc A ≈ 3000 Bq/mgμA h was reached and obtained promising results. The trial production (including irradiation, extraction of the final product ^{99m}Tc from irradiated material, chemistry, quality control) for ^{99m}Tc was established. An article including all these results is now submitted to the journal "Nuclear Medicine and Biology" [1].