

Phantom measurements of ^{74}As and ^{18}F at a Focus 120 small animal PET scanner

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Introduction: The positron emitter ^{74}As ($T_{1/2} = 17.8\text{d}$) has been used in the 1950's as carrier-added arsenate for brain imaging with PET [1] and then disappeared with increasing development of isotope production and design of no-carrier-added (nca) radiopharmaceuticals. Now nca separation techniques for radioactive arsenic isotopes are available and labeling chemistry for interesting biomolecules that are suitable for molecular imaging like monoclonal antibodies (mab) is established [2]. Molecular imaging with sophisticated ^{74}As -labelled pharmaceuticals seems to be possible.

The aim of these phantom measurements (Fig.1) is to test the resolution of ^{74}As at the small animal PET camera Focus 120 and to compare the results with the resolution parameter of ^{18}F . A plexiglas phantom was developed in the institute's workshop, Fig. 1.



Fig. 1: Plexiglas phantom with 3 drills of 2, 3 and 4 mm in diameter, each.

Experimental: 300 mg of proton irradiated GeO_2 ($3\ \mu\text{A}$, $1\ \mu\text{Ah}$) containing ^{74}As are dissolved in 2 ml of 5 M NaOH. The phantom is filled with a total volume of 1.5 ml of this solution corresponding to 750 kBq of ^{74}As (measured with HPGe detector, Fig. 2) and measured for 10 h (Fig. 3). The same phantom was filled with 10 MBq of ^{18}F in water and measured for 1 h.

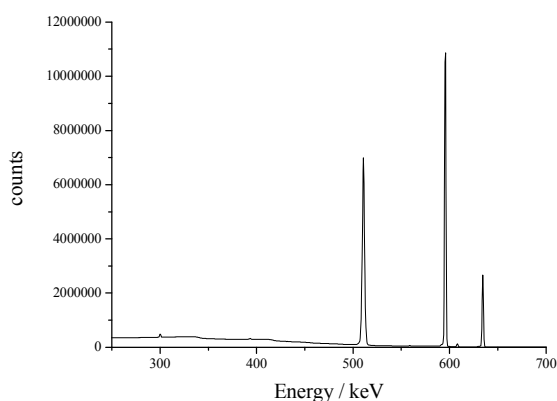


Fig.2: γ -spectrum of ^{74}As with lines at 511, 595 and 635 keV

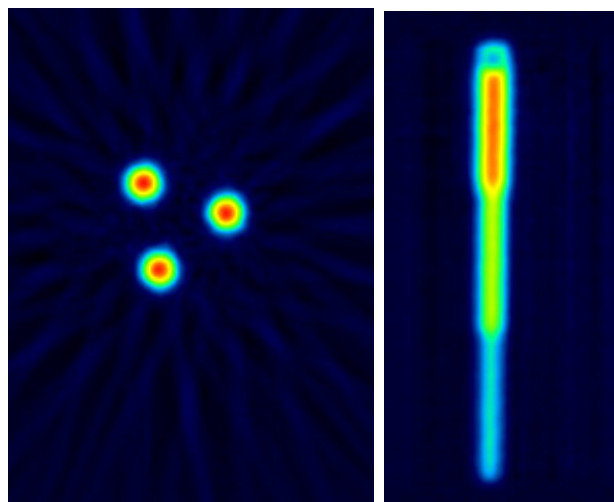


Fig.3: coronar and saggital PET images with ^{74}As in a phantom from Fig.1

Results: The comparative measurements of ^{74}As and ^{18}F show that ^{74}As is a useful isotope for PET imaging. Its resolution is close to that of ^{18}F (see Tab. 1) [3]. This is caused by the low mean β^+ -energy of only 128 keV of ^{74}As .

Tab. 1: Resolution of ^{74}As and ^{18}F

Real size [mm]	^{74}As FWHM [mm]	^{18}F FWHM [mm]
4	3.80	3.71
3	3.11	3.02
2	2.76	2.62
E_{β^+} (mean) [keV]	128	242

References:

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