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Target concepts for the ISOLPHARM project

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ISOLPHARM [1] (ISOL technique for radioPHARMaceuticals) is a project devoted to the discovery and development of high specific activity radiopharmaceuticals exploiting radionuclides producible with the future SPES (Selective Production of Exotic Species) ISOL (Isotope Separation On-Line) facility at INFN-LNL.
The strength point of such production method is the capability to produce a wide set of intrinsically carrier-free nuclides with high flexibility, since different radioisotopes can be extracted separately from the same production target by simply adjusting the settings of the electromagnetic separator. In particular, ISOLPHARM could have the capability to provide nuclides with medically relevant decay properties but limited availability, such as 111Ag, 43Sc, 47Sc, 67Cu, 149Tb, 152Tb and 155Tb, once a suitable production target is identified.
In the presented work Uranium Carbide (UCx) is proposed as production target for 111Ag, Zirconium Germanide (ZrGe) for 67Cu, along with 64Cu [2], Titanium Carbide (TiC) or Titanium Boride (TiB2) for 43Sc and 47Sc, and Gadolinium Boride (GdB4) for 149Tb, 152Tb and 155Tb. The feasibility of the production of the desired nuclides was subsequently evaluated by means of Monte Carlo codes, in particular FLUKA and Geant4, and promising yields were calculated. Furthermore, in the case of the ZrGe target, provided the lack of experimental measurements on the natGe(p,X)64Cu and natGe(p,X)67Cu reactions, dedicated nuclear cross section studies were performed.
Furthermore, such study included also the performance of tests with stable counterparts of the desired nuclides, aimed to investigate the capability of SPES technologies to ionize, accelerate and selectively collect single isotopes of the elements of interest.

References

[1] F. Borgna et al., Appl. Radiat. Isot., 2017.
[2] F. Borgna et al., Molecules, vol. 23, no. 10, 2018.

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