Contribution ID: **2** Type: **Oral**

ISOLPHARM project: Development of two preclinical imaging devices for Ag-111 β and γ radiation

Thursday, 23 May 2024 08:30 (20 minutes)

Interesting radionuclides for nuclear medicine applications are usually produced in cyclotrons or in nuclear research reactors. These production methods are typically associated with highly enriched target costs and with contaminated products. In this context, the ISOLPHARM project, the medical application of ISOL SPES facility, aims to produce radionuclides of medical interest with high purity.
The ISOLPHARM project is backed by a wide and interdisciplinary collaboration of several University departments and Institutes. During the last six years, three INFN-CSN5 experiments and a PRIN project ,ISOLPHARM_CORE, demonstrated the feasibility of this production method for carrier-free β-emitting radionuclides. This technology will overcome the limits of the current radiopharmaceutical production methods: the low specific activity and the high costs of the enriched material.
Ag-111 is a radionuclide that can be produced by the ISOLPHARM method with high purity and high production rate with respect to the standard neutron irradiation of enriched Pd-110 targets in nuclear reactors. Ag-111 is a β- (average energy 360 keV) and γ emitter (342 keV and 245 keV) with a half-life of 7.45 days. It has the potential to be a theranostic radionuclide thanks to its gamma emission that can be used to perform diagnosis with Single Photon Emission Computed Tomography (SPECT).
The ISOLPHARM project is currently promoting a three-year INFN-CSN5 experiment called ADMIRAL, the aim is to investigate the therapeutic and diagnostic potential of Ag-111. Regarding preclinical diagnosis, two complementary devices are under development: a detector sensitive to the β emission of the radionuclide and a γ camera sensitive to the gamma emission. A commercial multimodal imaging system will be used as a reference system for both devices. In fact, it can perform scintigraphy and Cerenkov Luminescence Imaging (CLI) using the β and γ radiation respectively. The γ-camera optimized for the Ag-111 radiation energy is the first step toward a clinical SPECT that could be used for imaging of Ag-111-based radiopharmaceuticals.
In this contribution, preliminary data regarding the β detector and the γ camera under development are presented. These data are integrated with the Geant4 simulation toolkit that is designed to track the passage of particles through matter

Field

Systems and applications

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Session Classification: High-performance preclinical and organ-specific systems

Track Classification: High-performance preclinical and organ-specific systems