Contribution ID: **114** Type: **Oral**

Efficient production routes of 129m,131m,133Xe for a novel medical imaging technique, gamma-MRI

Tuesday, 18 July 2023 16:10 (15 minutes)

The future gamma-MRI imaging modality will allow the simultaneous exploitation the advantages of SPECT – sensitivity of gamma-ray detection, and MRI – spatial resolution and flexibility. The combination of these technique requires use gamma-emitting nuclei (like in SPECT) with higlhly polarized spins, leading to anisotropic emission of gamma-ray, and thus make possible to manipulate these states by adding rf pulses (like in MRI). The signal in gamma-MRI is the change in the ratio of gamma rays emitted longitudinally and transversally to the spin (and magnetic field) direction. The first nuclei used in the project are 11/2- spin isomers ^{129m}Xe(T1/2=8.9days), ^{131m}Xe(T1/2=11.8days) and ^{133m}Xe(T1/2=2.2days).

An efficient production of the ^{129m,131m,133m}Xe is one of the most important of the first stage of gamma-MRI project. This contribution will present two main routes of selected xenon isomers production tested so far. The first method is based on neutron irradiation of stable ^{128}Xe and ^{129}Xe samples in the high-flux nuclear reactors: RHF reactor at Intitute Laue-Langevin (ILL, Grenoble, France) and MARIA reactor in the National Centre for Nuclear Research (NCBJ, Swierk, Poland). The second method of production is an extraction of ^{129m,131m,133m}Xe from uranium carbide (UCx) target hitting by proton beam at ISOLDE, CERN. Both methods provide high values of xenon isomers activities that can be extracted efficiently and used in polarization experiments.

The presentation will give a brief introduction to the gamma-MRI technique and will mention the results of xenon isomers production by using both methods. It will then briefly describe the method of metastable xenon samples characterization.

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Session Classification: Session 7B

Track Classification: Applications