ID de Contribution: **152** Type: **Non spécifié**

In vitro dosimetry for assessment of Targeted-Alpha-Therapy*

lundi 24 octobre 2022 16:30 (30 minutes)

Recent developments in heavy ions production increased access to alpha-emitting radioisotopes and opened the door to their use in internal radiotherapy[1]. Targeted alpha therapy is of interest for dedicated applications such as the treatment of disseminated brain metastases[2][3], their radiation range in biological matter covering only a few dozens of micrometers. However, when alpha-emitting radionuclides undergo in vitro assessment, additional care must be taken compared to beta-emitters because of the higher linear energy transfer values of alpha particles. Indeed, the dose delivered to the cells becomes significantly dependent on the spatial distribution of the radionuclides in the culture medium[4]. Knowledge of this distribution would thus allow dose-effect relationships assessments and make comparisons to other irradiation methods more reliable.

We present here an in vitro dosimetry system using silicon semiconductor diodes placed below custom-made culture wells, which record energy spectra of the alpha particles passing through the culture medium and cell layer. A detector chamber protecting the electronics was designed to carry out the measurements inside a cell culture incubator. A spectral deconvolution method was developed to extrapolate the radionuclide spatial distribution from energy spectra acquired during in vitro experiments and compute the dose delivered to the cells. Since our custom-made wells are compatible with microscopy imaging, dose-relationship effects can be directly evaluated for all culture wells.

Reliability of the methodology has been assessed and demonstrated dose computation errors limited to 3% when applied to simulated 212Pb irradiations. Applications of our methodology carried out in preliminary experiments with 212Pb and 223Ra showed that the common homogenous distribution hypothesis could lead to up to 50% dose underestimation. They also revealed that the different radionuclides of complex decay chains present different spatial distributions, which has further consequences on the dose computation and highlights the necessity of new experimental dosimetry methods.

REFERENCES
[1] F. Guerard et al., Q J Nucl. Med. Mol. Im. 59, 161-7 (2015)
[2] A. Corroyer-Dulmont et al., Neuro-Oncology 22(3), 357-68 (2020)
[3] N. Falzone et al., Theranostics 8(1), 292-303 (2018).
[4] A.M. Frelin-Labalme et al., Med. Phys. 47(3), 1317-26 (2020)

*This project has received financial support from the CNRS through the MITI interdisciplinary programs.

Auteur principal: DOUDARD, Alexis (Grand Accélérateur National d'Ions Lourds (GANIL), CEA/DRF CNRS/IN2P3)

Co-auteurs: FRELIN-LABALME, Anne-Marie (Grand Accélérateur National d'Ions Lourds (GANIL), CEA/DRF CNRS/IN2P3); CORROYER-DULMONT, Aurélien (Medical Physics Department, CLCC François Baclesse); JAUDET, Cyril (Medical Physics Department, CLCC François Baclesse); BERNAUDIN, Myriam (Normandie Univ, UNICAEN, CNRS, ISTCT, GIP CYCERON); VALABLE, Samuel (CAEN, CNRS, ISTCT, GIP CYCERON); LEDOUX, Xavier (Grand Accélérateur National d'Ions Lourds (GANIL), CEA/DRF CNRS/IN2P3)

Orateur: DOUDARD, Alexis (Grand Accélérateur National d'Ions Lourds (GANIL), CEA/DRF CNRS/IN2P3)

Classification de Session: Instrumentation & Interdisciplinaire

Classification de thématique: Nuclear Physics