EUROPEAN SYNCHROTRON RADIATION FACILITY
ESRF User Office
CS 40220, F-38043 GRENOBLE Cedex 9, France
Delivery address: 71 avenue des Martyrs, 38000 GRENOBLE, France
Tel: +33 (0)4 7688 2552; fax: +33 (0)4 7688 2020; email: useroff@esrf.fr; web: http://www.esrf.fr

Nanoscintillators for dose-enhancement and UV-C induced damage: *in vitro* studies

Beamtime: From January 21st to January 25th 2021

Experiment performed:
We investigated the efficacy of two types of nanoscintillators to potentiate radiotherapy, namely $Y_3Al_5O_{12}$:Pr and $LuPO_4$:Pr,Nd, synthesized by Dr G. Dantelle (Institut Néel, Grenoble) and RMD company (Boston, USA), respectively.
Their efficacy was investigated on 3D microtumors of pancreatic cells grown in adhesion (PANC-1). We initially planned on investigating two cell lines. However, one of the two cell lines that was ordered for the experiment didn't grow. We are currently in discussion with the vendor to obtain a new vial of the cells.
A single dose of 10 Gy was delivered to the cultures at various energies: 37.92 keV, 50 keV, 61.31 keV, 62.31 keV and 80 keV.

In addition, cuvettes containing the nanoscintillators and a chemical probe sensitive to hydroxyl radicals, and to a lesser extend to singlet oxygen were irradiated with increasing X-ray doses at these various energies. After each increment of the dose received by the sample, the fluorescence spectrum of the chemical probe was measured on a setup that we brought on site and that was specifically developed for this beamtime. Figure 1 represents the fluorescence spectra of the chemical probes measured after incremental irradiations with monochromatic X-rays (from 0 Gy to 64 Gy cumulated).

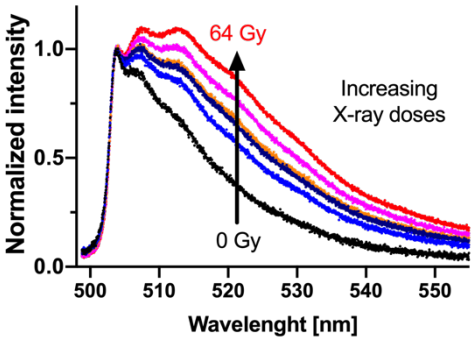

Figure 1: Fluorescence intensity of a chemical probe sensitive to hydroxyl radicals and to a lesser extend to singlet oxygen after incremental irradiation with X-rays.

Results obtained:
The 3D cultures have been maintained at culture conditions for another ten days after the irradiation. During this period of time, they were imaged every three days to monitor the growth of the microtumors. Ten days after irradiation, the cultures were subjected to a viability assay and the plates were imaged by confocal microscopy to assess the viability of the remaining microtumors as well as their sizes. The results are currently being analysed and processed.
As for the measurement using the chemical probe, we were able to validate the experimental protocol as we measured an increasing amount of reactive oxygen species generated with increasing doses of X-rays. A more detailed analysis of these results is also still ongoing.