Modelling cell survival in AuNP-enhanced radiotherapy using voxelized cell geometries

Several studies show that the combination of high-Z nanoparticles and external radiotherapy leads to an increased radiation effect in tumoral cells without an increase of the patient dose.

The objective of this work is to develop simulation tools that allow the analysis and interpretation of radiobiology studies with multifunctional nanoparticles (NPs). To do that, we developed a method to reconstruct confocal microscopy images that allows using voxelized detailed cell geometries in MC simulations using TOPAS.

Simulations of several irradiations (Cobalt-60, 160 kVp X-ray and 18 MeV proton beam) mimicking the ones used in the *in vitro* experiments at C2TN and ICNAS were performed. Based on these simulations, the dose distributions at the subcellular scale were obtained for different AuNPs concentrations. The microdosimetric distributions in cells were used to predict cell survival fractions, using the Local Effect Model (LEM).

The results obtained in the simulations were compared with the biological *in vitro* experimental results, and a good agreement between them was verified.