AbstractID: 5705 Title: Experimental validation of the Inner Shell Ionisation model to predict the radiosensitisation induced by the IDU and BrDU halogenated pyrimidine.

Purpose - Halogenated pyrimidines (IDU and BrDU) are heavy atoms compounds used as radiosensitizers. For IUdR, it has been questionned if inner shell ionisations (ISI) and Auger cascades that are rare events using megavoltage beams could be at the origin of the radiosensitization. The purpose of this work is to validate experimentally the ISI model previously published by the authors. This model involves the photon spectrum degradation in the tissues and the ISI induced by secondary electron knock-on.

Material and Methods - The ISI model predicts that the primary photon energy, irradiation depth, and type of halogen influence the Sensitization Enhancement Ratio (SER). Radiobiological assay were used to evaluate cell survival of the radioresistant CHO cell line using ^{192}Ir or ^{60}Co irradiation at various depths in water phantoms (2, 5 and 10 cm). Cells were grown in exponential or in plateau phase to account for different α/β ratios, and exposed 3 days before irradiation to 4µmol of IDU or BrDU. The experimental validation of the ISI model was realized by testing for each experimental condition the correlation between i/- the theoretical SER calculated using Monte Carlo simulation of the overdosage due to Auger cascades; and ii/- the SER calculated from the radiobiological assays.

Results – The experimental SER values are in the same range than the theoretical one, and they are significantly correlated ($p=0.017$). As predicted by the ISI model, there is an influence of depth and energy that is stronger for the IDU than the BrDU. Also, as predicted by the model, the largest SER is found using IDU and ^{192}Ir.

Conclusions – The ISI model is robust in predicting the radiosensitisation for a given experimental situation. Based on a pure particle-matter interaction modelisation, the ISI model could be extended to other particles type, including electrons, protons of heavy ions.