Proposition de stages et mémoires

2020-2021

Le Service de Métrologie Nucléaire poursuit des activités dans les domaines de la proton thérapie et de la physique des accélérateurs avec plusieurs partenaires incluant l'Organisation Européenne pour la recherche nucléaire (CERN), Ion Beam Applications (IBA), le SCK-CEN et Royal Holloway (University of London). Les mémoires suivants sont proposés dans le cadre de ces collaborations aux étudiants de MA2 pour l'année académique 2020-2021.

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Development of a voxelized anthropomorphic phantom for Monte-Carlo simulations of dose deposition patterns based on CT images

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Monte-Carlo simulations are known to be the most accurate methods to access dose deposition patterns during beam-matter interaction processes. Although their day-to-day use in radiation therapy clinical environment is limited by the required computation time, these methods remain powerful tools for the accurate modelling of advanced radiation therapy systems such as proton therapy facilities, with the ultimate objective of benchmarking treatment planning systems (TPS's).

This Master's thesis aims to develop a voxelized model of an anthropomorphic phantom, based on CT images. Using pydicom, a python package for converting complex Digital Imaging COMmunication (DICOM) files into natural pythonic structures, the student will implement an interface that can generate a physical model of predefined parts of a human body, at the state-of-the-art level of detail. This model will then be coupled with Beam Delivery Simulation (BDSIM), a Geant4-based particle tracking and Monte-Carlo simulations toolkit, to compute the resulting dose deposition patterns when interacting with clinical proton beams.

Extensive Monte-Carlo simulations will be carried out using a realistic model of the IBA Proteus One system. All results will be discussed in detail with experts at IBA.

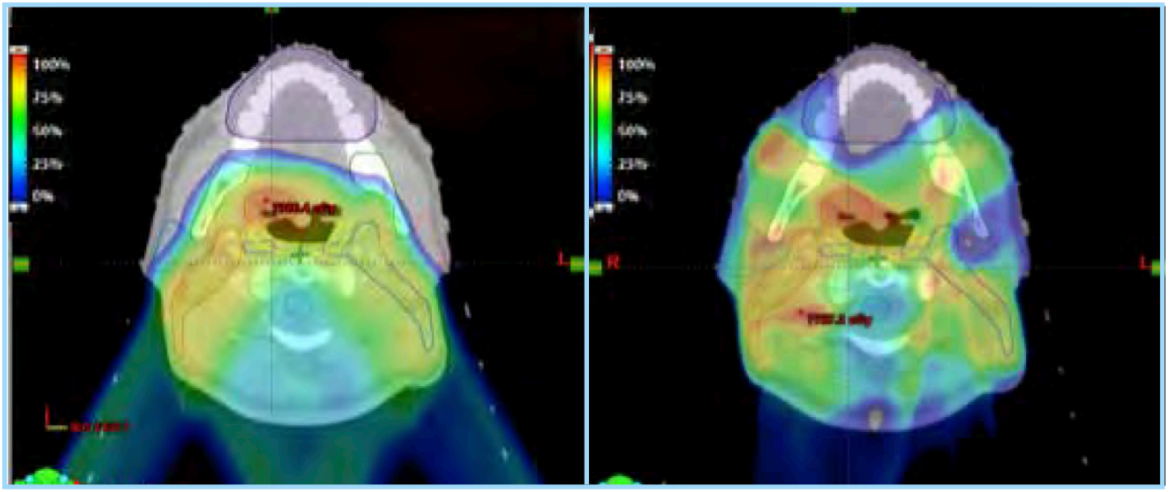

Figure 1 CT scan and deposited dose.