Characterization of beam quality correction factors associated to a double cavity ionization chamber

Background

Quality assurance (QA) of radiation therapy systems is fundamental to guarantee the accuracy of a treatment. During these QA, ionization chambers (IC) are often use to monitor the precision of the delivery system by performing dose-to-water measurements. The latter requires the application of a beam quality correction factor (k_{Q,Q_0}) when considering a particle beam quality Q different from the reference beam quality Q_0 used during the calibration of the IC. These kQ factors are IC-dependent and tabulated in different types of beams for marketed IC.

However, current IC might not be suited for modern treatment modalities such as Proton FLASH Therapy (PFT), as the ultra-high dose rates involved create a large amount of ion recombination within the air cavity which becomes complex to correct. Currently, new design of IC are investigated to overcome this issue and require the determination of their respective kQ factors.

Work

In this project, we will consider a recently proposed model of IC involving a double air cavity, which looks promising for PFT applications. Using the Monte Carlo simulation toolkit Gate/Geant4, we will model the IC then simulate its irradiation in order to calculate the kQ factors of each cavity for proton beams. In a second step, the initial geometry of the IC will be slightly modified to study any geometrical dependence of the kQ factor.

Prerequisite

- Basic progamming skills in python

Period

- 1 year

Location

This project will take place in the Radiophysics and MRI physics laboratory located at the Jules Bordet institute on the Erasme campus.

Supervisor

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