
Tomotherapy : from AirQA to TransitQA

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Résumé

Introduction: Since the acquisition of our Tomotherapy in 2011, we have developed a method of validating the treatment of patients without additional measuring instruments. The idea was to use the onboard detector (OBD). This previously published [1] model for Tomotherapy treatment plan verification (called AirQA) has been enhanced in order to take into account patient and couch transmission (we call it TransitQA). TransitQA is an innovative method for Tomotherapy transit dosimetry using the OBD. AirQA estimates the OBD signal during irradiation without anything in the beam path from the leaf control sinogram, allowing to check whether the planned treatment is correctly delivered by the machine. TransitQA allows to check the treatment delivery with the patient on the couch, potentially showing the effects of changes in the patient anatomy and delivery errors.

Methods: AirQA was for us a well-controlled concept in 2015[1]. Today more than 500 patient treatments have been validated by this method. This great experience has made it possible to go further in the project. Patient and couch transmission have been added to the model, using the OBD projections of the pre-treatment megavoltage computed tomography (MVCT). The difference in the energy spectra between the imaging and treatment beam has been corrected by an exponent on the MVCT projections, consisting in the ratio of the mass attenuation coefficients. This exponent has been found not to vary significantly with the atomic number Z , giving the opportunity to apply this procedure to heterogeneous media like patients. The attenuated OBD projections acquired during the treatment are compared to the model via a signed χ -index analysis. The dose criterion was 5% of the 95th percentile of the dose distribution and the distance to agreement was 4 mm.

Results: Our method has been applied to a heterogeneous phantom with 98.1% of point passing the gamma evaluation test, showing that the model is able to predict attenuated OBD projection. The method has been applied on two representative patients, during the whole treatment, showing a great sensitivity.

Conclusions: This talk describes the experience of the AirQA and also establishes the proof of concept of transit dosimetry for all patients treated by Tomotherapy. Moreover, this method called TransitQA can be a surrogate for in-vivo dosimetry.

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References:

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