
Deriving the mean excitation energy map from dual-energy and proton computed tomography

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Abstract

The mean excitation energy, I , is an essential quantity for proton treatment planning. This work investigated the feasibility of extracting the spatial distribution of I by combining two computed tomography (CT) modalities, dual-energy CT and proton CT, which provided the spatial distribution of the relative electron density and the stopping power relative to water, respectively. We provided the analytical derivation of I as well as its uncertainty. Results were validated on simulated X-ray and proton CT images of a digital anthropomorphic phantom. Accuracy was below 15% with a large uncertainty, which demonstrated the potential and limits of the technique.

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