AbstractID: 2993 Title: Extracting CT data in an image-guided radiotherapy benchtop where continuous radiation contaminates image data

Purpose:
A subtraction technique is used to extract kilovoltage computed tomograpy (kVCT) image information from a data set that has the combined response from imaging and treatment radiations. This data acquisition problem addresses an imaging/radiotherapy system that has a source that cannot be pulsed, i.e. a radioactive source.

Method and Materials:
A benchtop image-guided radiotherapy system uses a single CT detector and data acquisition system for imaging and treatment verification. The treatment radiation exposes every data collection cycle (DCC) and image radiation exposes every other DCC. Hence, sequential DCC alternates between the detector response from only the treatment radiation and the combined response from both the imaging and treatment radiations. To isolate the detector response from the imaging radiation, the image data set is produced from the subtraction of adjacent DCC. To demonstrate the effectiveness of this subtraction technique, CT images produced from this extracted data (extract-CT) are compared to conventional kVCT images.

Results:
Images of simulated tissue equivalent cylinders from the extract-CT and kVCT are similar. However, when comparing regions of uniformity, the standard deviation in pixel values are noticeably lower in kVCT. In extract-CT, the standard deviation of pixel values in tissue equivalent trabecular bone, liver, breast, and adipose are respectively 7.1%, 5.3%, 31%, and 36% higher than kVCT.

Conclusion:
A dual-source synchronization and data extraction method demonstrates that only a single detector and data acquisition system is required for a combined imaging/ radiotherapy system. The subtraction method presented in this work compensates for continuous radiation contamination of imaging data. However, the image quality is still compromised when compared to images without contamination.

Conflict of Interest (only if applicable):

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