AbstractID: 4859 Title: Computed Tomography with Separate Primary and Scattered Radiation

Purpose: Separating primary and scattered radiation in cone-beam Computed Tomography to improve image quality.

Method and Materials: Earlier generations of CT uses narrow beams or fan beams of x-rays, which suffer little from scattered x-ray photons. Newer generations of CT systems, however, use cone-beamed x-ray beams are associated with large amount of scatter radiations that tend to blur the reconstructed images based on the radiation absorbed by the detectors. In the low-energy range (~100 kV) of x-ray photons involved in diagnostic imaging, the scatter-to-primary (SPR) is on the order of 1, as compared to megavoltage x-rays, where typical SPR is on the order of 0.1. Swindell and Evans (Med. Phys., vol. 23, p. 63, 1996) had computed that the central axis SPR is almost linear with beam area, and is also almost linear with depth in water for a 6MV beam. Three methods are proposed to separate primary and scattered radiation in cone-beam CT based on the ideas in the field of radiation therapy: (1) using a relationship between SPR and distance to the radiation source, in conjunction with a two-layer detector array; (2) using a pencil beam to sample primary dose; and (3) using Monte Carlo simulations to reconstruct primary and scattered radiation.

Results: Simulations suggest that separate primary image and scattered images can be obtained, with the primary image at an improved image quality as compared with the image from the total radiation.

Conclusion: Separate primary and scattered images can be obtained through mathematical means and a simple upgrade of detector array to achieve better images and more information. .

Conflict of Interest: None.