

## AbstractID: 13722 Title: An inverse planning method for intensity modulated computed tomography

**Purpose:** Efficient management of X-ray fluence is a key factor in minimizing radiation dose to the patient in computed tomography (CT). Current methods to reduce exposure to patients utilize fixed fluence patterns that do not account for the full complexity of human anatomy. Modulation of the fluence intensity across the X-ray beam, independently for each projection, has the potential to obtain prescribed image quality in regions of interest (ROIs), while reducing radiation to the patient. This work presents a potential approach to solving the inverse problem of seeking fluence modulation profiles for achieving user-prescribed, image quality plans in intensity-modulated computed tomography (IMCT).

**Method and Materials:** Image quality plans were defined by specifying signal-to-noise ratio (SNR) criteria for ROIs in simulated water and anthropomorphic phantoms. Modulation profiles were then generated using a simulated annealing optimization method that attempts to achieve the prescribed spatially-dependent SNR criteria. Priorities on high and low SNR regions were defined in terms of weights in the associated cost function. Results were analyzed by comparing regional SNR distributions to the prescribed criteria. Total and regional dose outcomes were also estimated.

**Results:** Optimized fluence patterns achieved regions of high and low SNR in all objects. Increasing the weights associated with the high SNR regions resulted in better agreement with prescribed values, but with some tradeoff in achieving arbitrarily low SNR values in surrounding regions. Performance of the algorithm was robust under increased complexity and heterogeneity of the object of interest. Total and regional dose reduction estimates were significant when compared to the case without modulation.

**Conclusion:** The results suggest that fluence patterns that achieve user-prescribed image quality plans in IMCT can be generated using an optimization method as presented. Dose estimates also indicate potentially significant reduction in radiation exposure to the patient via IMCT plans.