

## AbstractID: 3961 Title: Intensity-modulated Cone-beam CT for Patient-specific Distribution of SNR

### **Purpose:**

In order to maximize task-specific image quality for cone-beam CT systems used in image-guided radiation therapy, investigations are being performed to establish compensating filters capable of modulating the fluence pattern applied during image acquisition for patient and task-specific distributions of signal-to-noise (SNR). The repetitive image-guidance problem allows optimization at the patient-specific level by making use of previously acquired patient images to define regions of interest (ROIs) or a distribution of desired image quality. These ROIs or distributions can be employed to generate intensity modulated fluence patterns for application during acquisition.

### **Method and Materials:**

Investigations into the development of compensation systems for creating SNR patterns are performed through simulations and experimental studies on a bench-top cone-beam CT system (Varian 4030A flat-panel, Rad-92 X-ray tube, motorized rotation stage). Numerical simulations (Matlab™) on a Shepp-Logan phantom are employed to generate binarized masks according to defined ROIs in the object space. Modulation of noise containing sinogram data followed by filtered backprojection permits SNR distribution recovery. Experimental studies using modulating filters were performed to evaluate the robustness of the technique in realistic systems.

### **Results:**

Simulations into the feasibility of tailor made SNR patterns created by advanced compensation schemes show that it is possible to design a gantry angle dependent compensation system capable of achieving desired SNR in defined ROIs. Experimental results reveal the ability to modify SNR across images providing specific regions with improved SNR while reducing local and/or integral dose.

### **Conclusion:**

Cone-beam CT compensators have been explored to provide modulated, patient-specific, fluence patterns optimizing the distribution of SNR within the resulting image. This technique opens the opportunity to optimize image quality in the most clinically relevant regions of an image, while reducing dose to the patient by reducing the fluence intensity outside defined ROIs.