AbstractID: 4674 Title: The Influence of Bowtie Filter Selection, Patient Size and Patient Centering on CT Dose and Image Noise

Purpose: Bowtie filters have been used on CT scanners for many years to reduce patient dose. In this study we rigorously characterized bowtie filter dose and noise performance and discovered some significant clinical implications for the CT scanner technologist.

Methods and Materials: Various size and shape phantoms were scanned on a GE LightSpeed VCT scanner using each available bowtie filter with phantoms positioned at 0 mm, 30 mm and 60 mm below isocenter. Surface and CTDI doses were measured along with image noise. Relationships for dose and noise were determined using regression methods and compared to computer simulated results. An algorithm was developed to determine the centering error from scout scans and subsequently used to evaluate the clinical implications for 273 adult body patients.

Results: The measured noise and dose performance agreed with simulations and indicated an optimum bowtie filter can be selected as a function of phantom size. The 32cm CTDI phantom scanned on the large, medium and small bowtie filters produced a dose savings of 29%, 24%, and 17% respectively compared to the flat filter for similar image noise. However, the surface dose increased by 18% and 41% for the miscentered cases while image noise increased by 2% and 13% with the optimum CTDI phantom bowtie. The noise increased even more (5% and 20%) for a miscentered nominal body shaped phantom. The clinical scout scan analysis indicated that 54% of patients were miscentered by 20 mm to 60 mm. With this miscentering, the surface dose penalty for the 32 cm CTDI phantom would range from 22 % to 71% assuming mAs is also increased to compensate for noise,.

Conclusions: Clinical image quality and dose efficiency can be significantly improved on scanners with bowtie filters if technologists can nominally center the patient region to be scanned.