AbstractID: 7483 Title: Noise equivalent quanta of CT images: results and challenges

Purpose: To evaluate changes in noise equivalent quanta (NEQ) as technique factors are varied in CT, and to evaluate NPS, MTF, and NEQ as standard quantitative metrics for CT image quality assessment.

Method and Materials: The modulation transfer function [MTF(f)] of a GE lightspeed16, clinical CT scanner was measured. A 13μm, nickel-chromium wire was scanned at 120kVp and 400mAs to obtain a point spread function (PSF). Three reconstruction filters were evaluated. The measured PSF was integrated to obtain the line spread function (LSF), and the MTF(f) was then computed. Ten CT scans of a 20 cm diameter water-filled pipe were also acquired to measure the noise power spectra [NPS(f)] on the same scanner. The mAs was varied from 10 to 400mAs at constant kVp, and the kVp was varied from 80 to 140kVp at constant mAs. Images using each of the reconstruction filters were evaluated. Using N x N regions of interest (ROI) the NPS(f) was computed by calculating the 2D FFT of each ROI and averaging all of the magnitude, squared FFT results. A minimum of 64 ROI were used per volume, and different ROI placement distributions were evaluated. The 2D results were averaged radially to obtain the 1D NPS(f). The NEQ(f) was computed by dividing the $MTF^2(f)$ by the NPS(f).

Results: The MTF(f) measurement is straightforward and the NPS(f) metric for CT images demonstrates behavior consistent with trends in photon fluence and apodizing filter behavior. The NPS(f) and NEQ(f) curves demonstrated sensitive changes with kVp, mAs, and slice thickness.

Conclusion: While NPS(f) and NEQ(f) normalization issues exist due to the normalization of CT images into Hounsfield Units, these metrics are sensitive to changes in technique and slice thickness changes and therefore are strong candidates for routine quantitative assessment of CT image quality.

Conflict of Interest (only if applicable):