AbstractID: 6583 Title: Noise Stationarity in Spiral CT

Purpose:
The properties of noise in CT images are important in system design, algorithm development, and assessment of diagnostic observer performance, as well as for developing accurate dose reduction simulators. Conventional analysis assumes noise stationarity, even though it is well known that elements in a CT scanner, such as bowtie filters or tube-current modulation, as well as filtered backprojection reconstruction, introduce variation in measurement statistics. In this presentation, two additional contributors to nonstationarity, hardware component variation and data interpolation, are analyzed, and the properties of noise in CT images are characterized.

Method and Materials:
Raw sinogram data was collected from open gantry scans. Offline reconstruction software, with access to data at individual processing steps, such as linear interpolation, was used for image reconstruction. White noise data was injected at various stages of reconstruction and changes in statistical properties at subsequent processing steps measured. Multiple simulations were used to create data ensembles for analysis. Covariance measures were calculated in the sinogram and image domains.

Results:
Raw CT data is nonstationary during the acquisition cycle, with covariances as high as 20% in unattenuated signals. Image reconstruction steps, such as linear interpolation and filtered backprojection, introduce variations in noise power on the order of +/- 50% in sinogram data. The variation of noise power can be up to 600% across a uniform image. The off-diagonal covariance coefficients are on the order of 10% with nearest neighbor pixels.

Conclusion:
The conventional assumption of noise stationarity in CT images needs to be extended to include additional processes that introduce local variations in image statistics.

Conflict of Interest (only if applicable): NONE