

## AbstractID: 5620 Title: Noise and nodule detectability in simulated cone beam CT imaging

**Purpose:** To evaluate and quantify the impact of various types of noise (quantum noise, photon scatter, flat panel detector blurring, and system noise) on the nodule detectability in simulated cone beam CT (CBCT) images by conducting the eight-alternative forced choice (8-AFC) observer performance experiment.

**Method and Materials:** We used Radon transform formalism to mathematically model a 3D chest phantom with spherical nodules of various sizes. Quantum noise, photon scatter, detector blurring, and system noise were then simulated and added to the projection images individually. The projection images were reconstructed by using the Feldkamp algorithm and the final images were then used for the observer performance study. Other impact factors for the image quality (e.g., contrast variation, x-ray dose, nodule size, number of projection images, cone beam angle etc.) were also incorporated into the reading study. Detection curves were then determined statistically from the 8-AFC experimental data by using a maximum-likelihood method. Nodule detectability was then quantified directly from the reading performance participated by 6 observers in the 8-AFC tests.

**Results:** Our preliminary data indicated that at the high x-ray dose level, photon scatter had the highest impact on the simulated CBCT images; while at the low dose level, system noise had the biggest impact. At all tested dose levels, detector blurring had the lowest impact on the detectability. In consistent with the previous theoretical study, the nodule detectability can be improved by increasing the number of projection images.

**Conclusion:** Our work indicated that using photon scatter correction techniques and reducing the system noise had the biggest potential to improve the CBCT image quality. We are currently investigating the impact of various scatter reduction algorithms and reconstruction methods on the CBCT image quality.

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