# AbstractID: 11763 Title: Accurate noise modeling of cone-beam CT projection data


**Purpose:** To study noise properties of low-dose cone-beam CT (CBCT) projection data and to improve the performance of statistics-based image processing algorithms for dose reduction in CBCT with a more accurate projection data noise model.

**Method and Materials:** We first performed repeated scan on an anthropomorphic chest phantom using an Acuity simulator (Varian Medical Systems, Palo Alto, CA). The data acquisition protocols included a tube voltage of 125 kVp, tube current 10 mA and duration of tube pulse 10 ms. At a fixed gantry angle, 500 repeated projections were acquired. From the repeated measurements, we first calculate the mean and variance of each detector pixel and then calculated the correlation coefficients of noise among detector pixels. The knowledge of the noise properties of CBCT projection was incorporated into a statistical image process algorithm based on the penalized weighted least-squares (PWLS) criterion. The PWLS criterion with the improved noise model was then used to suppress noise in low-dose CBCT projections.

**Results:** Our analyses on repeated measurements show that the noise correlation coefficients are non-zero between nearest neighboring pixels of CBCT projection data. An experimental phantom study shows that the PWLS with improved noise model can suppress the noise in low-dose CBCT effectively without noticeable loss of resolution.

**Conclusion:** Noise is correlated among nearest neighbors of CBCT projection data. An accurate noise model of CBCT projection data is established for statistics-based image processing algorithm. CBCT dose can be significantly reduced through using the PWLS-based projection smoothing algorithm that incorporates the projection noise correlation.