AbstractID: 8401 Title: A quantitative assessment of the effects of a simple dead detector pixel correction method for megavoltage cone beam CT images

Purpose:
Determining the extremes such that correction methods for missing or truncated projection data begin to fail could aid in the design of more efficient imaging systems in the future. We quantitatively assessed the effectiveness of a dead detector pixel correction method for megavoltage cone beam computed tomography (MVCBCT).

Materials and Methods:
Ninety-six MVCBCT images of an image quality phantom were reconstructed from projections that were acquired from four MVision™-equipped Siemens Oncor™ linacs with 1024x1024 amorphous silicon electronic portal imaging devices (EPIDs). Both 8 monitor unit (MU) and 60 MU head-and-neck scanning protocols were used for the acquisitions. Dead pixel maps were simulated for the cases of randomly distributed singular dead pixels and 13-dead-pixel clusters, each with six dead pixel percentages: 2%, 25%, 75%, 80%, 90%, and 95%. Transmission images were corrected in orthogonal directions using a 1-D line-by-line linear interpolation algorithm.

Results:
Image quality for the baseline case (< 0.5% dead pixels) and the case of 75% coverage by 13-dead-pixel clusters was similar. Image quality began to degrade severely after the EPID was covered to 80% by 13-dead-pixel clusters and 90% for singular dead pixels. Higher acquisition MU decreased the standard deviation of the difference images (corrected minus baseline), but had no effect on the means of the difference images.

Conclusions:
With a simple correction method, MVCBCT images are relatively insensitive to randomly distributed dead detector pixels until 80-90% of the EPID is covered with dead detector pixels. Image degradation for the same percentage of dead detectors was more pronounced when the EPID was covered with clusters of 13 dead pixels than with singular dead pixels, and was only weakly dependent on the MU used during the image acquisition.