AbstractID: 5035 Title: Reduction of ring artifacts in cone beam CT: Artifact detection and correction for flat panel imagers

Purpose:
Defective pixels in a flat panel detector may be characterized by a nonlinear signal response drastically different from those in the neighboring pixels. They could lead to ring artifacts in cone beam CT. In this presentation, we will describe and demonstrate the use of a filter based calibration technique to detect these pixels. In addition, we will employ this technique as a flat field correction method to correct nonlinear signal response.

Methods and materials:
To force the signal responses of all pixels to vary smoothly without sudden changes, we acquired images at fixed mAs but with various filtrations. Each filtered image is fitted to a smooth surface whose values are close to those of normal pixels but vary smoothly in the image. The ratios of the surface fit values to the original values were then computed on a pixel-by-pixel basis and used to map pixel values during subsequent image acquisition. This mapping would compensate for the nonlinear signal response associated with the defective pixels thus eliminating the ring artifacts. Using the surface fits as the reference, defective pixels were detected by automatic thresholding.

Results:
Using filter based calibration, defective (~0.035 %) pixels were successfully detected and corrected for. Therefore, ring artifacts were largely eliminated in cone beam CT images. A reduction in patterned noise artifacts in the projection images was also observed. The automated surface fitting procedure was found to be robust.

Conclusions:
Although the conventional flat field correction addresses non-uniform response across the detector, artifacts may still form as the pixel response varies with the beam quality and signal intensity. The filter based calibration procedure was successfully used to detect and correct for these artifacts.

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