AbstractID: 7351 Title: Motion blurring correction for a cone beam CT system with image decomposition and deconvolution method

Purpose: To improve the image resolution of a cone beam breast CT system by correcting the image blurring caused by gantry motion for a system works under continuous fluoroscopy acquisition mode.

Method and Materials: Computer simulation models were built to simulate the effects on CT system resolution from different subcomponents, including the focal spot distribution and gantry motion. The system MTF results showed that image resolution degraded from the center towards the edge of the FOV, along the azimuthal direction. The major cause of this degradation was the gantry motion during continuous fluoroscopy acquisition. Azimuthal MTF results from computer simulation were used to generate a 2-D MTF response function to model the system resolution property by fitting discrete data points into a set of 3rd order polynomials. To preserve the image resolution of CT images on the radial direction, the original CT images were converted from the Cartesian coordinates into a new orthogonal coordinate system by the following transformation:

$$R = \sqrt{x^2 + y^2}$$

$$T = (a\tan(\frac{y}{x}) + \pi) \cdot R$$

For each radial position, the image data were de-convolved with corresponding system MTF in frequency domain along the azimuthal direction (along T axis). CT Images were converted back to Cartesian coordinates after deconvolution by:

$$x = R \cdot \cos(\frac{T - \pi}{R} \cdot \frac{180^\circ}{\pi})$$

$$y = R \cdot \sin(\frac{T - \pi}{R} \cdot \frac{180^\circ}{\pi})$$

Results: A full view 2D MTF function was generated from computer simulations. With the presented method, the azimuthal resolution of the CT image was improved while the radial resolution was preserved. This method was applied to simulated phantom images and clinical breast CT images, qualitative observations showed improved spatial resolution along azimuthal direction.

Conclusion: The full view 2D MTF function proved to be sufficient to model the spatial resolution of a cone beam CT scanner, which is a non-isotropic, shift-variant system. The presented novel image decomposition and deconvolution method demonstrated the promising potential to correct for the spatial resolution degradation.

Conflict of Interest (only if applicable): None.