AbstractID: 2357 Title: Framework for Respiration-Correlated Cone-Beam CT

Accurate volumetric imaging in the thorax and abdomen is challenged by the presence of respiration-induced motion. The periodic nature of this motion permits reconstruction of images at each phase of the breathing cycle. Typically, phase is estimated from external surrogates, such as optical tracking systems or pneumotach measures of lung volume. The development of a methodology for phase determination directly from the projection set would eliminate the need for tertiary surrogates and reduce the potential for systematic phase offsets. In this investigation, a framework for determination of appropriate apertures for projection-based analysis and determination of phase is presented. A 3D aperture shape and location is identified in reconstructions (or orthogonal projections) and the location of this aperture in the projected space forms the basis for analysis. Within a projected aperture, linear and non-linear metrics (mean signal, max value, gradient strength and location, etc.) are computed to evaluate phase and strength of correlation. The framework was tested using an Elekta Synergy XVI system for cone-beam CT imaging of a free-breathing New Zealand white rabbit. The acquisition consisted of 578 projections over 360^o captured in 215 seconds (120kVp, 0.8mAs per projection). A modified Feldkamp algorithm was used to reconstruct volume images at 600x400x600 voxels with an isotropic spatial resolution of 0.25 mm. Respiration-correlated reconstructions of the expiration phase show a marked increase in lung detail and reduction of diaphragm blurring artifacts. The variations in projection density over 360^o result in minor streak artifacts in the reconstruction at various phases.