

AbstractID: 11817 Title: Temporal Resolution Improvement using PICCS in MDCT Cardiac Imaging

Purpose: The current paradigm for temporal resolution improvement is to add more source-detector units and/or increase the gantry rotation speed. The purpose of this letter is to present an innovative alternative method to improve temporal resolution by at least a factor of 2 for all MDCT scanners, without requiring hardware modification.

Methods: The central enabling technology is a most recently developed image reconstruction method: Prior Image Constrained Compressed Sensing (PICCS). Using the method, cardiac CT images can be accurately reconstructed using projection data acquired in an angular range of about 120 degrees, which is roughly 50% of the standard short-scan angular range (~240 degrees for an MDCT scanner). As a result, the temporal resolution of MDCT cardiac imaging can be universally improved by approximately a factor of 2. In order to validate the proposed method, two in vivo animal experiments were conducted using a state-of-the-art 64-slice CT scanner (GE Healthcare, Waukesha, WI) at different gantry rotation times and different heart rates. One animal was scanned at heart rate of 83 beat per minute (bpm) using 400ms gantry rotation time and the second animal was scanned at 94bpm using 350ms gantry rotation time respectively.

Results: Cardiac coronary CT imaging can be successfully performed at high heart rates using a single source MDCT scanner with gantry rotation time of 400ms and 350ms.

Conclusions: Using the proposed PICCS method, temporal resolution of cardiac CT imaging can be effectively improved by approximately a factor of two without modifying any scanner hardware. This potentially provides a new method for single source MDCT scanners to achieve motion artifact-free coronary CT imaging for most patients without prescription of beta blocker. This method also enables dual source MDCT scanner to achieve higher temporal resolution without further hardware modifications.