WHOLE BODY IMAGING WITH DYNAMIC VOLUME 320-ROW CT

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ABSTRACT

State of the art of CT technology will be presented. It has a z-coverage of 16cm to cover most of the organs in one single, non-helical, rotation. Whole body imaging using different scan methods will be presented, and a comparison in terms of scan time with helical scan mode will be discussed.

Index Terms— 320-row CT, whole body imaging, variable helical pitch

1. INTRODUCTION

Computed tomography (CT) remains one of the most important imaging modalities due to its widespread availability and its rapid performance. The introduction of multidetector scanners in the last decades has enabled fast helical scanning over a longer scan-range. However, due to the limitation of conventional detector width of maximum 40mm, whole body imaging takes longer time.

With the recent introduction of a dynamic volume CT, Aquilion ONE™, whole body coverage by non-helical rotation has become possible for the first time in the history of CT due to the enhanced detector width of 16cm. Each reconstructed 3D volume represents exactly the same phase (arterial and venous) producing isophasic imaging. These arterial and venous phases can then be displayed either separately or simultaneously in a fusion image.

This state of the art CT scanner enables simultaneous imaging the complete vascular system of the whole body with stitching technique. In addition, new imaging options such as whole brain CT perfusion imaging combined with blood flow are feasible now for the first time.

In this paper, the initial image quality will be compared with that of the current scanner with improved reconstruction algorithm. A Rando™ man phantom [1] was used in this comparison.

| Available data by circular acquisition |

| Not available data (cause artifact) |

Figure 1 Rando phantom developed by the phantom laboratory [1] was scanned on the 320-detector row CT scanner at Leiden University Medical Center, The Netherlands.

2. RECONSTRUCTION ALGORITHM

Volumes of up to 16cm are acquired with the Aquilion ONE. While there is data for the entire scanned volume, there are complex challenges to produce artifact free images due to the underlying reconstruction algorithm. In the first installation of the reconstruction algorithm, Toshiba ConeXact™ was developed to produce distortion free images of the entire volume. Figure 2 below represents a diagrammatical view of how the data is processed. The core regions at the center of the data represents missing Radon data (plane integrals) [2] which leads to streak artifacts, particularly in the MPR views, varying in severity depending on the anatomy.
Further development based on clinical feedback was necessary to overcome these undesired streak artifacts, which lead to an Organ Specific Reconstruction (OSR)-based ConeXact. This algorithm has been refined over time to adequately compensate for the missing data shown above. Figure 3 explains the principle of OSR. The available data region is consistent and is determined by the scanner geometry. Therefore the core area where there is missing Radon data is also consistent and can be estimated. Once the missing data is estimated, it is simply subtracted from the original resulting in an artifact-free volume.

**Figure 3** The concept of OSR

### 3. WIDE VOLUME SCAN

Comparing the scan times, we found a Wide Volume scan (3.8s) takes approximately half of the time compared to the helical scan (7.2s) for identical scan distance (Fig. 4). Preparation times due to phantom positioning, protocol adjustment and scanogram were identical.

### 4. VARIABLE HELICAL PITCH

Variable helical pitch is an advanced scanning mode that enables two different scan protocols with two different scan parameters to be combined into a single helical examination, as demonstrated in Fig. 5.

**Figure 5** Variable helical pitch principle

It can be used to acquire a gated and a non-gated scan in a single examination using a single examination using a single contrast bolus. For example, for coronary artery CTA, ECG-gated with cardiac pitch is used, and for CTA of the aorta a non-gated with a standard CTA pitch is used.

This unique technique enables users to combine trauma applications such as a brain scan (detailed pitch) and body scan (standard pitch) in one continuous scan. Furthermore, radiation dose can be saved up to 55% to improve patient care.

### 5. CONCLUSION

CT whole body imaging technique using dynamic volume 320-row CT has been described. 320-detector row CT was initially developed for dynamic volume imaging, for example 4D-CTA of the brain. With the 64-row mode implemented in the 320-detector row scanner it is possible to select the optimum protocol for any study.

Using the OSR-based reconstruction algorithm, in combination with “Wide Volume” scan technique, we show a fast whole body CT imaging.

### 6. REFERENCES
