High-Speed Computed Tomography System Using a Spherical Anode for Improved Medical Imaging

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing an X-ray computed tomography system that uses a spherical anode to rapidly measure in three dimensions.

OVERVIEW

Computed tomography (CT) is a medical imaging method that creates 3-D images from a large set of 2-D images by measuring the attenuation of an X-ray beam's signal that is directed transversely through the patient. Both the X-ray source and detector array are mounted on a gantry and rotated around the patient. Radial measurements, or “projections,” are taken at various angles in a transverse plane to make up a “projection set” forming a 2-D cross-sectional image.

The time required to collect projection data for conventional fan-beam CT can be substantial and may even preclude its use when large volumes need to be monitored in real-time or during unavoidable patient motion. Two solutions to decrease required time include continuous spiral/helical CT scans and the use of wider fan beams. The rotational speed of the gantry is still a limiting factor for these solutions. It has been addressed by the use of an electron beam that scans a hemi-cylindrical anode array to simulate the X-ray source rotating around the patient, which leaves no mechanical movement as a limiting factor. However, this technique still limits the CT scan to just planar data collection.

THE INVENTION

UW–Madison researchers have developed an X-ray tomographic system that uses a virtual spherical anode to break free of conventional planar CT data acquisition by acquiring 3-D projections. Instead of measuring radially in one plane, data is measured radially in a 3-D starburst pattern. This process provides a number of benefits, including the ability to collect missing X-ray beam data that has left the intended plane of interest, flexibility in projection angle selection to minimize or measure tissue motion, and the ability to rapidly collect sparse projection sets for large volumes on a real-time basis.

The X-ray tomographic system would consist of a patient support, an X-ray source, a multi-element detector, and a controller. Next to the patient support is the X-ray source, which...
consists of an electron gun and a spherical anode in between the patient support and the gun. Opposite the anode from the patient support is the multi-element detector that receives the X-rays. The multi-element detector and the X-ray source communicate via the controller, which steers the electron gun across the spherical anode to acquire a series of projection sets over a range of latitudinal and longitudinal angles.

APPLICATIONS

• Provides X-ray tomographic scans for medical imaging of patients

KEY BENEFITS

• Collects missing data due to beam divergence without the need to scan multiple planes
• Increases flexibility in projection angle selection to minimize or measure tissue motion
• Rapidly collects sparse projection sets for large volume imaging on a real-time basis without being constrained to a helical or orbital acquisition sequence

ADDITIONAL INFORMATION

Tech Fields
Medical Imaging - CT

CONTACT INFORMATION

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or (608) 262-5733.