



Improved CT Imaging with Multisource X-Ray Tube

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a new X-ray tube design that enables faster CT imaging, dose reduction and superior image quality.

Overview

Computed tomography (CT) provides rapid, noninvasive imaging at high resolution. Conventional CT systems include a gantry, one or two X-ray tubes and a detector assembly that rotate together around a patient at high speed. The system requires heavy and sophisticated control hardware and electronics.

One reason CT systems are so complex is that X-ray tubes have remained essentially unchanged for 80 years. The standard design features a single cathode that emits electrons towards a rotating anode. The reliance on a single electron source means the entire X-ray tube has to be rotated around a patient for a complete scan. This introduces costs and mechanical challenges associated with a rotating gantry. Furthermore, the single source tube has constrained new imaging techniques that could lower radiation doses to patients.

The Invention

UW–Madison researchers have developed a compact, multisource X-ray tube for use in CT imaging. The new tubes can deliver high current from an arbitrary number of focal spots. Utilizing a modular design, the tubes may be arranged in a variety of configurations to suit a particular application.

A module consists of a series of electron emitters that can be switched on and off at high frequency, and are directed towards a single stationary target that is actively cooled. A large voltage between the emitters and the target accelerates the electrons to high energy. Upon impact with the target, the electrons produce an X-ray spectrum. An electromagnet is used to ‘sweep’ the multiple electron beams over the cooled target.

In effect, X-rays are generated around a patient in rapid succession, much faster than the mechanical motion of a rotating gantry.

Applications

- New X-ray tube design for CT imaging (e.g., ultra-high speed cardiac imaging, dose reduction CT)
- Hypervelocity projectile imaging
- Flow measurements in nuclear reactors

Key Benefits

- Compact, low-cost design
- Mechanically simpler and easier to manufacture
- Enables unlimited number of focal spot positions around a patient
- Can be run at higher power than traditional systems
- Unprecedented efficiency levels (100kW tube can be realized using pulses on the order of 15 microseconds)
- Superior temporal resolution for more accurate diagnoses

- Active cooling
- Solves rotating gantry problem
- Adaptable to a variety of settings, applications and configurations

Stage of Development

The researchers have developed models and computer simulations, with intentions to build a prototype.

The development of this technology was supported by WARF Accelerator. WARF Accelerator selects WARF's most commercially promising technologies and provides expert assistance and funding to enable achievement of commercially significant milestones. WARF believes that these technologies are especially attractive opportunities for licensing.

Additional Information

Related Intellectual Property

- [View Continuation Patent in PDF format.](#)

Tech Fields

- [Medical Imaging : CT](#)

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846