Docket #: S14-092

In-Vivo Specific Absorption Rate Mapping using the Thermoacoustic Effect

Stanford researchers have proposed a new concept for direct measurement of specific absorption ratio (SAR), to be used as a safety assessment / monitoring tool for magnetic resonance imaging (MRI). This novel experimental method for in-vivo SAR measurement uses the thermoacoustic effect, in which ultrasound waves are emitted due to the absorption of pulsed or modulated RF/microwave energy. By detecting these ultrasound waves and reconstructing an image from them, a spatial SAR map of the patient can be produced. This provides a new capability for measurement of the spatial distribution of SAR in the human body, and directly addresses the unsolved problem of measuring local SAR in MRI.

Figure

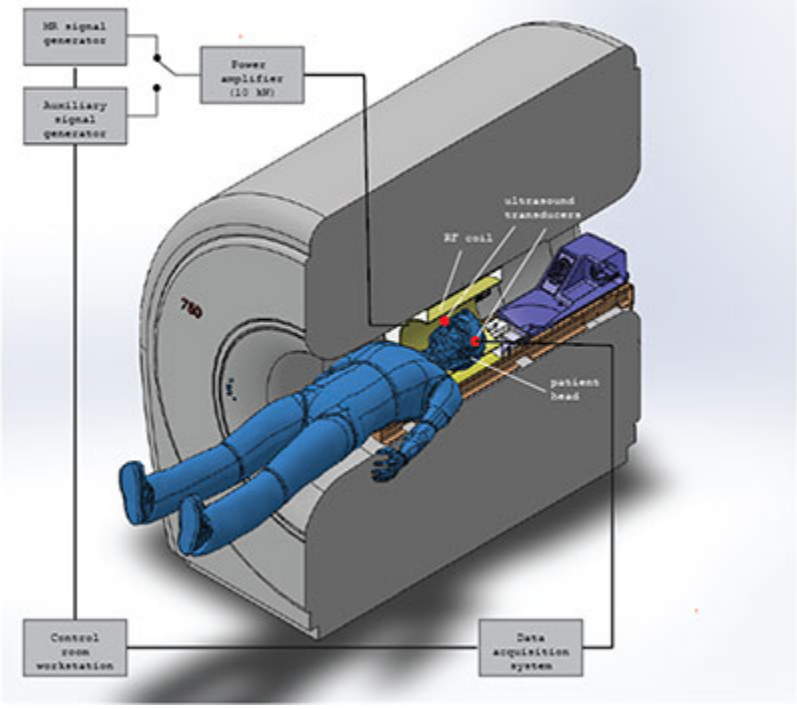


Fig. description: MR scanner with proposed closely coupling ultrasound transducer configuration.

Stage of Research

- **Proof-of -concept**
- A simulation framework to model this thermoacoustic SAR mapping concept was developed and results show good agreement between reconstructed and original SAR distributions and support the feasibility of direct experimental mapping of SAR distributions in vivo.
- Experiments have been conducted in phantoms which support the validity of the concept.

Applications

- High-field magnetic resonance imaging
- Safety monitoring
- Optimization of SAR patterns
- Hyperthermia monitoring and hotspot steering/optimization
- Microwave cancer detection monitoring

Advantages

- Practical method for experimentally measuring SAR non-invasively, in-vivo
- Employs thermoacoustic imaging which is well understood, hence providing feasibility support to this concept
- To-date, no existing method for local SAR monitoring

Publications

- U.S. Patent Application Serial No. 14/704,369.
- Simone Angela Winkler, Paul Picot, Michael Thornton, Brian Rutt "Conference Paper: Direct SAR Mapping by Thermoacoustic Imaging: A Feasibility Study" Proceedings International Society for Magnetic Resonance in Medicine, Milan, Italy; 05/2014

Patents

- Published Application: 20150316626

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