AbstractID: 2043 Title: Principles of AC Magnetic Fields for Objective and Continuous Target Localization in Radiation Therapy

A new method utilizing non-ionizing AC magnetic technology to perform continuous target localization and tracking during radiation therapy utilizing implanted transponders and a 4D localization system is described.

Prior to therapy, three wireless permanently implanted Beacon™ transponders mark a treatment target. Each transponder contains an inert, passive electronic circuit that is sealed in a biocompatible glass capsule. A 4D localization system includes an array with 4 source and 32 sensor coils. The array is placed in proximity to the transponders to accurately and objectively pinpoint the treatment target's location in three-dimensional space and updates the location in real-time. The source coils in the array generate an AC electromagnetic field to briefly excite the transponders between 300-500 kHz. Each excited transponder generates a magnetic field at its resonant frequency. The field is sensed by 32 sensor coils, and the process of excitation and sensing is repeated several hundred times. The received signals are averaged on a per-channel basis, thus improving the signal-to-noise ratio. The location of each transponder is inferred from the shape of the sensed field using an inversion algorithm. Surface infrared optical targets on the array are monitored by an optical subsystem to determine array position and orientation relative to isocenter. The transponders are continuously updated at 10 Hz. Based on customized thresholds, the target offset is continuously monitored to identify out-of-bounds conditions. The software interprets signals to define the 4D location with sub-millimeter accuracy as measured in a phantom.

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