

AbstractID: 7923 Title: Clinical Design of a System for Simultaneous Ultrasound Hyperthermia and Electron Beam Therapy

The Scanning Ultrasound Reflector Linear Arrays System (SURLAS) is an ultrasound hyperthermia device for the delivery of an electron/photon beam fraction(s) during a superficial hyperthermia treatment. Simultaneous thermoradiotherapy seeks to maximize both direct hyperthermic cytotoxicity and thermal radiosensitization. The SURLAS concept and feasibility have been previously tested and demonstrated, respectively. We are currently designing a *clinical* grade system that will be translated into our radiotherapy clinic after FDA IDE approval. In this presentation, we will describe the final applicator design, which has two parallel-opposed ultrasound arrays (operating at different frequencies) and a scanning dual-face acoustic reflector. This approach has been shown to provide 3D power deposition control with improved spatial resolution while offering a portal of homogeneous material that minimally perturbs electron beams. We will discuss the scanning reflector mechanism features that (a) minimized the applicator size and weight, (b) maintained geometrical alignment of the reflector and arrays, (c) ensured a reliable, safe and precise mechanism, and (d) minimized audible motor noise. Studies showed that (1) the optimal drive for the scanning mechanism is a stepper motor connected via a belt-pulley assembly (to isolate motor vibrations) to a helix lead-screw. The reflector is mounted on a screw-driven slider. Several motors were tested (compromising between size, weight, torque and noise); we opted for a relatively new 5-phase design that is compact and practically noiseless. Magnetic limit switches were chosen over optical and mechanical ones to automatically turn off ultrasound power and alert the operator when activated. (Support: NCI 2R01CA63121)