AbstractID: 13139 Title: Dynamic frame selection for in-vivo ultrasound temperature estimation during radiofrequency ablation

Purpose: Ultrasound echo-shifts due to temperature changes have been utilized to track temperature distributions in real-time to monitor ablative therapies. We present a motion compensation algorithm that reduces the impact of cardiac and respiratory motion on ultrasound-based temperature tracking methods.

***Method and Materials*:** Radiofrequency data acquisition was performed for RF ablated regions created in-vivo in pig kidneys at a frame rate of 2 frames/sec for two animals. Data was acquired using an Ultrasonix 500RP ultrasound system during RF ablation procedures. A region of interest that does not undergo ablation is selected in the first frame and the algorithm searches through subsequent frames to find the next frame with a high normalized cross-correlation coefficient value with the original frame. This ensures that displacements are tracked between frames at the same part of the respiratory and cardiac cycle. A comparison of two different two-dimensional displacement estimation algorithms (block matching and multi-level cross-correlation) was also performed.

Results: Both methods track displacements without significant errors after 30 seconds of ablation. However, streak artifacts in the block matching temperature map corrupt the temperature map for larger ablation durations due to displacement tracking errors. Multi-level however produces artifact free temperature maps over an entire 8 minute ablation procedure with temperature elevation from 37°C to 100°C.

Conclusions: Our results demonstrate the ability of the proposed motion compensation algorithm using dynamic frame selection in conjunction with the two-dimensional multi-level cross-correlation to track the temperature distribution. The multi-level cross-correlation method incorporates tracking of the lateral tissue expansion in addition to the axial deformation to improve the estimation performance. Dynamic frame selection enables optimization of the computational time in addition to reducing displacement noise artifacts introduced due to respiratory and cardiac motion and estimation of smaller frame-to-frame displacements at the full frame rate.