AbstractID: 5436 Title: Magnetic Resonance Electrical Impedance Mammography: A Feasibility Study

Purpose: To demonstrate the feasibility of a new imaging technique consisting in simultaneous Magnetic Resonance Mammography and Electrical Impedance Scanning of the breast which does not require theoretically fat suppression and injection of paramagnetic contrast agents.

Method and Materials: A theoretical formulation of the expected signal was developed and verified by the computer simulation demonstrating the distortion of the magnetic field caused by the injected currents. Two conducting breast phantoms were designed using breast tissue and tumor equivalent materials: (a) a soap phantom with a soap and salt solution as a cancer surrogate and (b) an agar phantom with a piece of fat-free hotdog as a cancer surrogate. The stabilization paddles in a Symphony Breast Biopsy Array were modified to include Faraday shield electrodes fed by a variable frequency power source. The phantoms were placed between the modified paddles and imaged with a Siemens Magnetom Symphony Maestro Class 1.5 Tesla system with the current densities reaching 4.5 A/m^2 and frequencies ranging from 200 Hz to 1000 Hz. Gradient re-phased, spin echo, and echo-planar sequences were tested to maximize the expected output signal. The images were subjected to statistical analysis to determine a set of parameters which produce detectable signal with minimal injected currents.

Results: The expected signal was observed in agreement with the simulation. The agar phantom proved to be more stable and showed consistency in the imaging results. A large number of variables, including imaging sequence parameters, experimental setup parameters, and phantom quality, requires a more thorough analysis of the proposed technique.

Conclusions: We have demonstrated the feasibility of simultaneous magnetic resonance and electrical impedance imaging that has the potential to revolutionize current Magnetic Resonance Mammography. A significant effort should be put into optimization of imaging parameters at minimum current without compromising patient safety or signal quality.