Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Towards Truly Quiet MRI: animal MRI magnetic field gradients as a test platform for acoustic noise reduction WILLIAM EDELSTEIN, ABDEL-MONEM EL-SHARKAWY, Johns Hopkins School of Medicine — Clinical MRI acoustic noise, often substantially exceeding 100 dB, causes patient anxiety and discomfort and interferes with functional MRI (fMRI) and interventional MRI. MRI acoustic noise reduction is a long-standing and difficult technical challenge. The noise is basically caused by large Lorentz forces on gradient windings—surrounding the patient bore—situated in strong magnetic fields (1.5 T, 3 T or higher). Pulsed currents of 300 A or more are switched through the gradient windings in sub-milliseconds. Experimenting with hardware noise reduction on clinical scanners is difficult and expensive because of the large scale and weight of clinical scanner components (gradient windings $\sim$ 1000 kg) that require special handling equipment in large engineering test facilities. Our approach is to produce a Truly Quiet (<70 dB) small-scale animal imager. Results serve as a test platform for acoustic noise reduction measures that can be implemented in clinical scanners. We have so far decreased noise in an animal scale imager from 108 dB to 71 dB, a 37 dB reduction. Our noise reduction measures include: a gradient container that can be evacuated; inflatable antivibration mounts to prevent transmission of vibrations from gradient winding to gradient container; vibration damping of wires going from gradient to the outside world via the gradient container; and a copper passive shield to prevent the generation of eddy currents in the metal cryostat inner bore, which in turn can vibrate and produce noise.

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Date submitted: 10 Oct 2012 Electronic form version 1.4