AbstractID: 10780 Title: Shielding of radio frequency noise from clinical linear accelerators for the linac-MR project

Purpose: To determine the efficacy of shielding RF noise generated by a linac during irradiation.

Method and Materials: The electric (E) and magnetic (H) field strengths generated by a medical linac during irradiation were measured using near field E and H probes connected with a 2 GHz digital oscilloscope and IEEE 488 data acquisition system. These measurements were performed both with and without our RF shield, which houses our 0.2 T MRI. These field measurements were then used to determine the power spectral density of RF noise as a function of frequency.

Results: The data measured without the RF shield shows several peaks in the power spectrum approaching levels of $1 mW/m^2$ in the frequency range 1-20 MHz. Above 5 MHz the measured data with the RF shield shows significantly reduced power levels. For example at 35 MHz the attenuation is 38.5 dB. The RF noise generated by a linac during the MR imaging k-space acquisition must be less than μWs. In a 50 kHz bin, our data indicates power densities of ~250, 69, 7.2 and 2.6 nW/m^2 at 8.5, 21.25, 42.5 and 63.75 MHz, corresponding to 0.2, 0.5 1.0 and 1.5 T MR resonant frequencies, respectively. For a typical surface coil used for human imaging, the surface area might be 20x20 cm^2. Thus the power available to a typical surface coil, according to our measurements, would be a maximum of 10, 2.76, 0.29 and 0.1 nW respectively. This does not include the coil efficiency which would further reduce the actual RF noise reaching the acquisition system.

Conclusion: The noise power levels measured using our RF shielding is much lower than those detected in typical human MR imaging.