AbstractID: 6630 Title: Study of RF interference between a linear accelerator and MRI

PURPOSE

To study methods to eliminate RF interference between a linear accelerator and MRI to facilitate the integration of a linac and MRI for real time image guidance.

METHODS AND MATERIALS

Linear accelerators function in a pulsed power mode by generating high current and voltage pulses with fast rise times by charging and discharging a PFN. Most of the power in the discharged pulse is contained in the DC component of the pulse, and is absorbed by the klystron/magnetron due to impedance matching at DC. However, the higher order frequencies in the pulse are not be transmitted to the load since the impedance match is only optimized at DC. These modes can resonate on the transmission line between PFN and load and transmit RF in the MHz range. This could interfere with the RF receiver of an MRI imager. Thus, it should be possible to control the frequency of RF pulsing noise by choosing an electrical delay line between the PFN and klystron/magnetron, which avoids the operating frequency of the MRI.

RESULTS

RF noises due to modulated current pulses were measured on a Varian 2100 EX linac, and suggest the resonance mechanism is correct. To further test this hypothesis, an experimental linear accelerator system is being re-configured. RF power measurements in the range of the operating frequency of a 0.2 T MRI are difficult due to long wavelengths (10s of m). Measurement antennas are being developed using finite element methods. Early simulations results of a dipole antenna are presented.

CONCLUSIONS

Initial measurements indicate that RF pulsing noise from a medical linac exhibits resonance like properties. This implies that the RF interference between a linac and MRI can be eliminated by a simple reconfiguration of the linac modulator, which would greatly simplify the integration of a linac and MRI.