AbstractID: 8539 Title: Measurement instrumentation to determine RF noise generated by a medical linac

Purpose: The goal of image-guided radiotherapy is to deliver the planned conformal radiation dose precisely to the target tumour volume and minimize dose to nearby normal tissue. To further this goal, integration of a linear accelerator (LINAC) with an MRI has been proposed. An obstacle to the integration of a LINAC with an MRI is the RF interference between the two devices. Our measurements indicate that LINAC induced RF occurs in the MHz range, with wavelengths on the order of 10s of meters, necessitating the RF measurements to be made in the near field. The purpose of this work is to develop and validate a method of measuring RF field patterns using standard dipole antennas both in near and far fields.

Method and Materials: To validate the measurement technique, near and far field electric (E) and magnetic (H) field patterns were measured using specialized E and H field probes from two dipole radiation sources, and compared to the theoretical values. Antennas and probes were mounted in controlled geometry using a specially made wooden stand. The wave impedance (E/H) was also calculated and compared to theory.

Results: For E and H fields, angular and radial field strength patterns demonstrate compliance with theory in both the near and far fields. The E field measurements oscillate around the theoretical falloff as a function radial distance, these oscillations are predominantly a result of reflections from the room structures. Our room simulations are consistent with this interpretation. Wave impedance in the near field agrees with theoretical predictions.

Conclusion: A technique to measure the RF field strength in the near and far fields has been demonstrated. This technique is suitable for measuring RF field values in the vicinity of a medical LINAC enabling quantification of RF interference between a LINAC and MRI.