

Purpose: Modern radiotherapy relies heavily on 3-D image based guidance to reduce treatment margins and to conform the dose distribution to the target shape. Due to the poor soft-tissue contrast and non-real-time nature of x-ray and ultrasound based image guidance, several groups are integrating an MRI and linear accelerator. One of several unresolved technical issues is RF interference between the two devices. The purpose of this presentation is to show that LINAC RF correlates with the operation of certain components of its pulsed power modulator (PPM).

Method and Materials: Electric (E) and magnetic (H) field temporal patterns (RF signals) were measured using separate E-field and H-field probes on three medical LINAC configurations: klystron and PPM in the same room; klystron and PPM in different rooms; and magnetron and PPM in the same room. Time resolved high voltage power supply (HVPS) current, pulse forming network (PFN) voltage, klystron current and klystron voltage, and magnetron current were all measured coinciding with the RF signals. All measured signals were compared in time and frequency domains.

Results: For a klystron powered LINAC, correlation between the HVPS current, and E and H field signals were observed in both the time and frequency domains. No correlation was observed between RF signals and the klystron current pulse. For a magnetron powered LINAC, correlation among HVPS current, magnetron current and RF signals was observed. RF signals coincided in time with the magnetron current, but the frequency spectrum were dissimilar.

Conclusion: The results suggest that charging of the PFN by the HVPS current is a mechanism of RF noise generation in the klystron based LINAC operation. For magnetron based PPMs the results further suggest the magnetron current pulse generates RF noise, however dissimilar frequency spectrum indicates an indirect and more complicated mechanism requiring further investigation.