AbstractID: 6891 Title: Magnetic Shielding of a Coupled MRI-Linac System

Purpose: To investigate the optimum requirements of magnetically shielding a Linac from an MRI coupled to it for the purpose of real-time image-guided adaptive radiotherapy. In addition, to investigate the effects on the MRI's magnetic field homogeneity due to the presence of the required shielding.

Method and Materials: Finite element method was used (COMSOL MultiPhysics) to model a Linac coupled to a 0.2 T bi-planar MRI system, and to calculate the magnetic fields in its vicinity**.** Associated shielding was optimized by varying sheets of shielding material (eg, iron, Mu Metal) to keep the MRI's magnetic fringe fields within the waveguide to less than 0.5 Gauss.

Results: We found that to reduce the MRI's magnetic fringe fields within the waveguide from 20 Gauss (unshielded waveguide) to the specific requirement of less than 0.5 Gauss, we require a 5 cm thick iron plate between the Linac and the MRI, and a 1 mm Mu Metal wrapping around the waveguide. An additional 5 cm plate is placed on the opposing side to improve magnetic field symmetry**.** The magnet's field inhomogenieties resulting from the shielding were calculated to be less than 142 ppm, and thus easily "shimmable".

Conclusion: Magnetic shielding is needed for operating a Linac coupled to a 0.2T MRI - system. We have optimized the shielding required to reduce the MRI's magnetic fringe fields within the waveguide to less than 0.5 Gauss by using simple and realizable passive shielding. Field inhomogeneities due to the presence of our shielding are sufficiently small that they can be easily corrected though conventional shimming techniques.