AbstractID: 13177 Title: Ion Chamber Dosimetry Modification under Strong Magnetic Field Conditions

Purpose: To examine the dose response of an ion chamber in an external magnetic field, and to simulate the energy deposition using the Monte Carlo technique.

Method and Materials:
This work investigates the response of a 0.6cm^3 Farmer chamber to an 11.17 mCi ^{137}Cs source under the influence of a 1.5 T magnetic field on a GE MRI scanner. A wooden frame was designed that allowed varying field direction measurements while keeping the source to chamber axis distance constant. Monte Carlo simulations were conducted using FLUKA, a particle physics transport package, to score the energy deposition and the average electron track length inside the cavity.

Results: Higher chamber current readings were obtained when a transverse (to chamber central axis) magnetic field was applied, compared to zero B field conditions. Lower readings were obtained when a longitudinal field was present. A 4.8% increase was observed for the transverse field measurements and negative voltage polarity while a 3.5% decrease was measured for the longitudinal case. The positive polarity measurements showed a 3.7% increase and an 11.5% decrease in transverse and longitudinal fields vs. a 4.0% increase and a 6.0% decrease found through Monte Carlo simulations. The average track length increased by 11.0% and decreased by 6.8% in transverse and the longitudinal fields.Varying the electric field applied to the electrodes showed no significant changes in chamber response.

Conclusion: The dose response of a Farmer chamber in an external magnetic field varies with the average charged particle trajectory length. The average trajectory depends on the B field magnitude and direction, and on the energy spectrum of the primary photon beam. Thus, an alignment with the B field direction would be essential. Smaller cavity chambers are expected to be affected less under B field conditions, and should be investigated in the future.