AbstractID: 13843 Title: Linac Waveguide Performance in the Presence of Parallel MR Fringe Fields

Purpose: To investigate the effects of magnetic fields which are parallel to a Linac waveguide and similar to those present in our Linac-MR system, on a Linac waveguide's performance. **Method and Materials:** Parallel homogeneous and MR-like magnetic fields of various strengths (29G - 144G) were applied to a 3D waveguide model emulating the Varian 600C Linac, previously developed by our group. MR-like fringe fields were approximated using a pair of 3D analytic current loops, whose dimensions and current were optimized to match the field strengths from the MR imager. PARMELA, a particle tracking software, was then used to evaluate the magnetic field effects on the waveguide's performance. The electron beam current, energy, FWHM, and center-of-mass (COM) position at the target were investigated as a function of field strength. **Results:** For parallel fields, an increase in the beam loss in the waveguide was observed. Parallel fields caused an added beam loss of 0.269%/G, while MR-like fields caused a 0.273%/G beam loss over the field range investigated, where we have demonstrated that most of the beam loss occurs in the electron gun. The energy and COM position of the electrons incident on the target is insensitive to changes in field strength, however there is a large effect on the distribution's FWHM. The FWHM increases from 0.12mm at 0G, to approximately 3.4mm at 125G, at a rate of 0.024mm/G. **Conclusions:** Our simulations have shown that under large parallel magnetic fields similar to those present in a Linac-MR system, a Varian 600C Linac is operational. There is however an effect on the percent beam loss and FWHM of the electron beam at the target, where the beam loss occures mostly at the electron gun. Negligable effects are seen on the electron energy and COM position at the target.