AbstractID: 13092 Title: The Effect of transverse magnetic fields on a simulated in-line 6 MV linac

Purpose: The linac waveguide is subjected to large magnetic fringe fields in a linac-MR hybrid system. An investigation is performed to determine the effect of transverse magnetic fields on a simulated in-line 6 MV medical linac.
Method and Materials: The program PARMELA was used calculate the electron beam loss per cavity with the linac waveguide subjected to external transverse fields. BEAMnrc and DOSXYZnrc were used to calculate the effect on 40x40, and 20x20 cm^2 field dose profiles and depth dose curves with the linac submersed in a transverse magnetic field. DOSRZnrc was used to determine the heating per cavity as a result of the beam loss and COMSOL was used to determine the resulting cavity resonant frequency changes due to cavity heating. Lastly, a calculation of leakage radiation caused by the excessive beam loss was performed using BEAMnrc.
Results: The beam loss was calculated to be 5±1, 22±1, and 49±1% over nominal for 2, 4 and 6 G magnetic fields respectively. The transverse magnetic fields caused a shifting of the electron spatial distribution at the target which resulted in a lateral shift of the dose profiles making 14.4% of all points fail a 1%/1mm acceptance criterion at a 6 G field. Through asymmetric jaw positions, the lateral shift in the dose profiles was reduced such that only 0.5% of all points failed. The frequency of the accelerating mode changed by 0.03 Hz due to heating, and a total leakage radiation of 0.007% of the radiation field was calculated.
Conclusion: The 6 MV linac investigated showed sufficient tolerance to be used in transverse magnetic fields larger than earth's field. The shifts observed in the dose profiles were reduced through asymmetric jaw positions such that only 0.5 % of the points failed a 1 %/ 1 mm criterion at 6 G.