AbstractID: 8863 Title: Comparison of electron beam characteristics between two ElektaTM LINAC models

Purpose: To compare the electron beam (EB) characteristics of two Elekta^{TM} linear accelerator (LINAC) models having significantly different treatment head designs.

Methods and Materials: An Elekta^{TM} Synergy^{TM} LINAC and a Synergy-S^{TM} (Beam Modulator^{TM}) are in clinical use at our institution. The Synergy^{TM} treatment head design replaced upper jaws with 40 MLC leaf pairs (1-cm wide projection at isocenter) followed by a backup diaphragm parallel to MLC leaves; lower conventional jaws are perpendicular to the MLC. Maximum field size at isocenter is 40cmx40cm. The Synergy-S^{TM} treatment head design replaced both upper and lower jaws with an 80 leaf (40 each side, 0.4cm leaf width at the isocenter) Beam Modulator^{TM} and two pairs of fixed outer diaphragms. Maximum field size projected at isocenter is 21cmx16cm. Electron applicators are attached directly to the treatment head on both machines. A Wellhöfer^{TM} blue water phantom system was used to measure and compare EB PDD, off-axis profiles and output factors for all EB energies on both machines at several different SSDs. Depths used for profile measurements were (1/2)R90, R90, R70, R50 and R_p+2cm. Field sizes for the output factor measurements are $2cm^2$-$10cm^2$.

Results: While beam energy matching was attempted by the engineer, compromises were required to meet both PDD and flatness specifications. Synergy-S^{TM} EBs were higher energies (as shown by PDDs comparisons) for same nominal energies. Off-axis profiles for Synergy-S^{TM} were more rounded than Synergy^{TM}. No significant difference between in-line and cross-line profiles was noted for either machine. Bremsstrahlung properties of both machines are similar. Output factors for fields defined with $6cm^2$ applicator of Synergy-S^{TM} are about 4% higher.

Conclusions: Electron beam characteristics of Synergy^{TM} and Synergy-S^{TM} are significantly different. Special caution should be taken when using the treatment planning beam model for one system to estimate the dose distribution for the other system.