AbstractID: 4386 Title: Dosimetry in a lung moving phantom

Purpose: Respiratory organ motion is known to be one of the largest intrafractional organ motions. In the lung phantom, secondary electron transport in addition to the photon transport tends to extend the dose disequilibrium region, resulting in a larger penumbra region and thus potentially different motion effect on dose distribution for IMRT fields. This study quantifies the effect of motion on dose distribution in lung medium.

Method and Materials: Measurements were performed in a water-equivalent made of solid water and a lung phantom composed of 15-cm thick 0.25 g/cm^2 cork slabs at several depths a computerized motion phantom. Dose distributions for 6 MV and 15 MV photon beams are measured for a 10x10 cm^2 open field and for IMRT fields. The motion is created using a ±1-cm motion amplitude and 6 second per breathing cycle. EDR2 films were used to determine the dose distribution with or without motion at various depths in the solid and lung phantom.

Results: At 10 cm depth, the penumbra of dose profile in the lung phantom is much broader than the solid phantom. The penumbra width increases with increasing photon energy. The effect of motion can be modeled with a motion kernel determined by the probability function of the breathing cycle and is independent of the phantom (solid or lung) types used. At 2.5 cm depth, the penumbra width between the lung and solid phantom is similar since the same solid water material was used above the point of measurement.

Conclusion: We have shown that dose distribution in a moving lung phantom can be predicted from the measured dose distribution in the static lung phantom and a motion kernel. The introduction of secondary electron transport actually reduces the effect of motion on the dose distribution because the penumbra width is wider in lung material.