AbstractID: 13556 Title: Validation of an electron Monte Carlo dose calculation algorithm in the presence of heterogeneities using radiochromic film.

Purpose: To validate electron beam dose distributions calculated with the electron Monte Carlo (eMC) algorithm in situations of bone and lung heterogeneities using radiochromic films.

Method and Materials: Four heterogeneous phantoms are used in this study. Radiochromic films are inserted in these phantoms, including in heterogeneous media, and the measured relative dose distributions are compared to eMC calculations. Phantoms A, B and C contain 1D heterogeneities, built with layers of lung and bone equivalent materials sandwiched in Plastic Water. Phantom A has 1.5 cm of Plastic Water, 9 cm of lung material, and 5 cm of Plastic Water. Phantom B has 1 cm of Plastic Water, 1 cm of bone material, and 5 cm of Plastic Water. Phantom C is similar to phantom B but has 2 cm of bone material. Phantom D is a thorax anthropomorphic phantom with 2D lung heterogeneities. Electron beams of 6, 9 , 12 and 18 MeV are delivered to these phantoms with a 10x10 cm^2 applicator.

Results: Percent depth dose (PDD) film measurements and eMC calculations agree within 2% or 3 mm for phantom A, and within 3% or 3 mm for phantoms B and C for almost all beam energies. One exception is observed with phantom B and the 6 MeV, where measured and calculated PDDs differ by up to 4 mm. Gamma analysis of the measured and calculated 2D dose distributions in phantom D agree with criteria of [3%, 3 mm] for 9, 12 and 18 MeV beams, and [5%, 3 mm] for the 6 MeV beam.

Conclusion: Dose calculations in heterogeneous media with eMC agree within 3% or 3 mm with radiochromic film measurements. 6 MeV beams are not modeled as accurately as other beam energies. The eMC algorithm is suitable for clinical dose calculations involving lung and bone heterogeneous media.