

AbstractID: 13777 Title: Investigation of various phantom materials for very high energy electron (VHEE) beams 150-250 MeV: A Monte Carlo study

**Purpose:** Very high energy electrons (150-250 MeV) is a new possible modality for radiation therapy. It is important to establish accurate dosimetry for this range of energies. In this study we evaluated the properties of dose deposition in various phantom materials for very high energy electron (VHEE) beams. **Methods and Materials:** A general purpose Monte Carlo code PENELOPE (2003) was used to generate phantom geometries modeling solid water, liquid water, polystyrene, and soft tissue (ICRP). A  $10 \times 10 \text{ cm}^2$  electron beam was modeled for  $50 \times 50 \times 50 \text{ cm}^3$  phantoms for energies of 150, 180, and 200 MeV. A  $10 \times 10 \text{ cm}^2$  electron beam was modeled for  $50 \times 50 \times 12 \text{ cm}^3$  for current clinical energy of 18 MeV. For all simulations  $2 \times 10^7$  incident primary particles were used. **Results:** For the 200 MeV beam, the max dose is as follows: Solid Water  $4.15 \times 10^{-12} \text{ Gy}$ ; Liquid Water  $4.31 \times 10^{-12} \text{ Gy}$ ; Polystyrene  $4.04 \times 10^{-12} \text{ Gy}$ ; Soft Tissue (ICRP)  $4.26 \times 10^{-12} \text{ Gy}$ . Standard calibration procedures compare measurements taken in a medium and compare to measurements made in water, for the same geometries. The dose at  $d_{\text{max}}$  is consistently less in the phantom and other materials than for water: Solid Water 96.3%; Polystyrene 93.7%; Soft Tissue (ICRP) 98.8%. Similar and consistent results are seen at the lower energies. **Conclusions:** Given the consistency of  $d_{\text{max}}$  and dose at  $d_{\text{max}}$  for the energies and materials studied, it would seem appropriate to use water equivalent phantoms to quantify output of a VHEE beam when scaled appropriately. Measurements made in solid water are most close to the measurements in water.