AbstractID: 1732 Title: Variability in the Position of the Virtual Source for Small Clinical Electron Beams

Small electron fields at extended treatment distances are often used clinically. For these fields, the effective source-to-surface distance (SSD) method is sometimes employed to predict the location of the virtual source, thus enabling a calculation of electron field output factors at these extended distances. This technique is well documented in the literature only for much larger electron field sizes. In the present work, we have studied the virtual source position for miniaturized electron fields as a function of circular cutouts with diameters from 2 to 9 cm and electron energies of 6, 9, 12, 16 and 20 MeV. As expected, the effective SSD was found to depend on cutout size as well as the electron beam energy. This dependence became very strong for cutouts below 4 cm diameter with the lower electron energies. For these fields, the effective SSD was found to be significantly shorter in comparison with the cone-collimated field. Output factors computed using the effective SSD methodology were further verified with measurements. In all the studied cases, the measured output factors (OF) at 110 cm were within 2% of the values predicted with the effective SSD method. In spite of the finding that there is a significant variation of the effective SSD with the electron beam energy and the cutout size, the method can be still used safely to predict the OF at least up to 110 cm SSD, provided the behavior of the virtual source is well characterized.