

Effects of Buildup Thickness and Material to Diode Detector SSD Dependence

The change of SSD brings two variations to the detector: a) instantaneous dose rate of the beam; b) character of the beam scatter and contamination. A theoretical model has been established to analyze the instantaneous dose rate dependence of the diode.¹ This paper studies the effects of the second variation part on the diode response.

Detectors using the same buildup material (brass) with different equivalent area densities were tested. The percentage difference in detector response at 70 cm relative to 100 cm SSD is: a) +8.8% with 0.1 g/cm², +4.0% with 0.5 g/cm², +1.3% with 1.5 g/cm² and +1.2% with 2.5 g/cm² for 6 MV beam; b) +20% with 0.1 g/cm², +4.6% with 1.5 g/cm², +3.0% with 2.5 g/cm² and +2.4% with 3.5 g/cm² for 18 MV beam. The data clearly show that lack of buildup could significantly increase the detector SSD dependence due to the beam scatter and contamination.

Detectors with buildup materials of different atomic numbers (13, 29, 42 and 73) but the same equivalent thickness were also tested for both 6 MV and 18 MV beam. The results demonstrate that SSD dependence of the diode detector is almost independent of the mass attenuation coefficient (μ/ρ). However, with the same equivalent thickness, the sensitivity of the diode detector increases with an increase in μ/ρ of the buildup material at a specified beam energy.

1. J. Shi *et al*, Med. Phys., Vol. 23, No. 6, p. 1072, 1996.