

### **Determination Of Off-axis Photon Beam Spectrum from the Off-axis Measured Depth Dose In The Build-up Region.**

Spectra were derived on and off the central ray of clinical photon beams from measured depth dose (MDD) data. The depth doses were measured for a small field ( $6 \times 6 \text{ cm}^2$ ) both along the central axis and 13 cm off-axis. Measured depth doses at shallow depths are used in the analysis since the range of the Compton generated electrons is strongly energy dependent. Depth doses for monoenergetic photon beams, at the same field size were obtained using Monte-Carlo simulations. The monoenergetic photon beam depth doses were used as basis functions in a Cimmino feasibility algorithm. The Cimmino algorithm finds the weights of monoenergetic DDs that minimizes the difference between the calculated and measured depth dose. The physical constraint that the derived spectrum varies smoothly with energy is imposed interactively. The depth doses derived with the spectral weights determined by the Cimmino algorithm agreed within 1% with the measured depth doses for the 6 and 15 MV photon beams from a linear accelerator both on and off the central ray. For both beam energies, the measured depth dose varied with distance from the central ray; resulting in derived spectra that depended on distance from the central ray. The change in the attenuation coefficient in water calculated for the on and off axis spectra was 5.4% and 4.9% for the 6 and 15 MV beams respectively which agrees within 2% with measured beam attenuation characteristics