AbstractID: 6818 Title: On the adequacy of shielding for 15-22 MeV electron beams

Purpose: It is customary to define block transmission as a fraction of open field dose at the depth of maximum dose (d_{max}) for an electron beam. The purpose of this study is to investigate the depth at which transmission should be measured and the adequacy of shielding for 15-22MeV electron beams to reduce the transmission to the regulatory level.

Method and Materials: Central axis data were collected in open and blocked beams in water phantom. Measurements were taken for a set of cones from 6x10 to 25x25cm^2, 100 cm SSD and 5 cm gap between the cone and water surface. Transmission factors as a function of depth and cone size were calculated. For the 22MeV electron beam, the effect of adding thicknesses of different attenuators (cerrobend, lead, bolus) was investigated. The data were verified independently in three institutions with similar accelerator model and electron energies. Monte Carlo simulations with PENELOPE code were performed to compare with measurements.

Results: Photon contamination of 15-22MeV electron beams in the open beam was in agreement with the manufacturer's specification. Maximum transmission for the blocked beam for all energies and cones occurred between 4-7 mm depth. The 15MeV electron beam was well attenuated for the standard cerrobend thickness. For 18 and 22MeV beams, maximum transmission varied from 5.9% to 7.5% and from 9.5% to 11% for the 6x10 to 25x25cm^2 cones, respectively. For the 15x15cm^2 cone, 30 mm thick cerrobend attenuated 22MeV beam to 5%. For 21MeV beam, Monte Carlo simulations showed maximum transmission from 10.6% to 11% for 10x10cm^2 and 25x25cm^2 cones, respectively.

Conclusion: The d_{max} dose under a blocked beam occurs closer to the surface than for the open beam. In order to decrease transmission to the regulatory level of 5%, 18-22MeV electron beams require additional shielding to supplement the standard cerrobend block.