AbstractID: 6479 Title: Functional Representation of Tissue Phantom Ratios for small Photon Fields

Purpose:
For small photon fields tabulated TPR data are not readily available. Aim of this work was to find a functional representation valid at all depths d and for fields as small as 4 mm side length s. Such functions generate high quality beam data as input to a treatment planning system, or for calculating monitor units and dose to any point in water for the full range of s and d required clinically.

Method and Materials:
For beams of 6 and 10 MV collimated with the Elekta Beam Modulator, TPR was measured in water with a shielded silicon detector. Field sizes were from 4x4mm² to 160x210mm². For each field size the TPR was fitted to
$\mathrm{TPR} = (D_s + (1 - D_s)(1 - \beta^d))\,\alpha\,\exp(-\mu(1 - \eta d)\,d)$. The first factor describes the build up, with D_s being the surface dose and β a build up gradient. α is a normalization factor, introduced to normalize TPRs to 1 at a depth of 10 cm. The exponential, describes the declining part of the curve, where μ is a pseudo attenuation coefficient and η a beam hardening coefficient. The field size dependence of the parameters was analyzed separately and appropriate functions were fitted to these data. The surface dose D_s was set to the respective mean values, while $\beta(s)$ was fitted to a power function and $\mu(s)$ and $\eta(s)$ to exponentials.

Results:
The measured TPR data could be fitted very well with the proposed function. Owing to the increasing amount of scattered photons μ decreases with field size. The beam hardening η turned out to be negative except for field sizes below 1 cm.

Conclusion:
The proposed model predicted TPRs generally better than with 1 % accuracy at all field sizes and depths. Its implementation improved the quality of monitor unit calculations.