## Quality Assurance of Head-Scatter Factors for Square and Rectangular Collimator Settings

The head-scatter factor (or collimator-scatter factor), *H*, for field sizes larger than  $3\times3$  cm<sup>2</sup> is caused by the scatter of photons in various structures in accelerator head (primarily the flattening filter) and by the backscatter of radiation into the monitor. We have developed an algorithm to parameterize these effects from a set of measurement for square collimator settings. The head-scatter factor for square field size is expressed as:  $H = (1 + a_1 \cdot c) \cdot (1 + a_2 \cdot erf (c/\lambda)^2) \cdot H_0$ , where  $a_1$  accounts for backscatter into the monitor,  $a_2$  is the scatter-to-primary ratio for head-scattered photons, and  $\lambda$  represents the width of the head-scatter photon "source" projected to the isocenter plane. The value of  $a_2$  and  $H_0$  can be used to QA the measured head-scatter factor, usually  $H_0 > 0.90$  and  $a_2 < 0.1$ . To calculate the head-scatter factor for rectangular fields,  $c_x \times c_y$ , two equivalent-square relations are used: one for backscatter, one for head-scatter. The two equivalent-square uses the same form:  $c = \frac{(1 + k) \cdot cy \cdot cx}{k \cdot cx + cy}$  but different geometrical factor *k*.  $k_{hs}$  and  $k_{bs}$  are determined from the head geometry and can be calculated without additional measurement.

measurement. For Varian accelerators, the results agree with measurements for rectangular fields, with a maximum deviation of less than 0.8%.