Title: Minimum absorbed dose limit for Gafchromic EBT2 film response after exposure to low-energy photons

Six EBT2 film (lot # F06110901) pieces (1cm²) per dose were exposed to x-rays of 50 kV, 80 kV, 120 kV and ⁶⁰Co gamma rays from a Leksell Gamma Knife at dose values from 50 mGy to 100 Gy. The x-ray beams were calibrated following the AAPMTG-61 protocol using ionization chambers calibrated at NIST or Wisconsin University depending on the beam quality, while the ⁶⁰Co gamma was calibrated in water using MD-V2-55 film. Each film piece was scanned once using a HP Scanjet 7650 document flatbed scanner in transmission mode, 48-bit color at 300 dpi spatial-resolution. The data analysis was made through the ImageJ. The measured light intensity for the red channel with its associate standard deviation was used to evaluate the netOD and its standard combined uncertainty. The absorbed dose as a function of the netOD was fitted using the logistic model and the relative combined uncertainties were evaluated for each energy photon beam.

Figure 1. Absorbed dose vs netOD. Weak dependence on the energy photon. The degree of energy-dependence is a function of dose.

Figure 2. Relative combined uncertainty vs dose. Lower is the energy photon, smaller is the minimum dose limit.

Figure 3. Relative response vs energy photons. The energy dependence is a function of the absorbed dose.