Purpose: To investigate the accuracy of the absorbed dose measured with Gafchromic EBT2 film in low-energy photon radiation fields

Methods: 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.

Results: EBT2 film response curve depends on the low-energy photons and the degree of energy-dependence is a function of absorbed dose. The absorbed dose relative combined uncertainty as a function of the absorbed dose indicates that the minimum absorbed dose limit is also energy dependent. Lower is the energy photon; more accurate is the measurement at low dose value. This can be explain by the fact that comparing to high energy photons, low energy photons can produce locally enough ionization density to create more color centre in the same film area.

Conclusions: Minimum absorbed dose limit of Gafchromic EBT2 films were found to be energy dependent. The response curve depends on the low-energy photons and the degree of energy-dependence is a function of absorbed dose

Funding Support, Disclosures, and Conflict of Interest:

This work is partially supported by DGAPA-UNAM grant IN102610 and Conacyt Mexico grant 127409