A novel method using Agfa-Kodak® Computer Radiography system for routine quality assurance tests on Linear Accelerators

Light versus radiation congruence and the symmetric and asymmetric jaw positioning checks are part of the routine quality assurance (QA) checks recommended by the AAPM Task Group 40 and 142. Currently, the general practices followed to make these measurements are qualitative in nature and prone to several random errors. We have developed a novel technique that is efficient, reproducible and allows storing quantitative values for the light/radiation coincidence and symmetric/asymmetric jaw positions with a single step setup. These detectors that have been extensively studied in both therapy and diagnostic imaging studies [1-2], was placed outside its cassette at the gantry isocenter. This detector was then exposed to a known field size of either 6/18 MV radiation delivered using 50 monitor units and no buildup. It is well known that light in the visible range causes photo etching of the radiation field in these detectors. Figure 1 shows the light field impression of a fixed size that was created on the latent image of the radiation field by moving the jaws in and leaving the light field on for 90 seconds. The outer portion of the dark border is representative of the radiation field boundary, while the lighter portion inside delineates the light field. Figure 2 is an extension of this concept, where the jaws were then asymmetrically moved to form a known field size within the light field and the bleached area was further irradiated with the radiation field to define asymmetric jaw boundaries. This detector is then processed using a Kodak® Scanner (ACR 2000i) and the dicom image is then analyzed using standard image processing software such as ImageJ (NIH) as shown in figure 3. At our institution we have developed a MATLAB based algorithm that can automatically analyze the dicom image of this measurement. The method has been verified for its reproducibility and the estimated uncertainty involving software based analysis has been found to be within +/- 0.2%; For the set of measurements performed in this study, we have been able to quantify the congruence between the light and the radiation field to be within 1mm of agreement. The method discussed here is very useful in determining consistency between the planned and the delivered radiation beam relative to the laser system, and hence serves as a quick and efficient clinical tool to perform routine quality checks of the beam delivery system.

References: