

Quality Assurance of Beam Accuracy for Leksell Gamma Unit

For the acceptance test and annual quality assurance of the Leksell Gamma Unit, measurement of the beam accuracy, defined as a distance between mechanical and radiological isocenters, poses a challenge to medical physicists. The specification for the beam accuracy is within 0.3-mm for the 4-mm collimator helmet. In this report, we introduce a simple technique to analyze the beam accuracy by using a conventional film densitometer plus mathematical modeling. A small piece of film was placed inside the film cassette containing a sharp needle. The needle is located such that its tip is exactly positioned at the mechanical isocenter. Before exposure, the film is pierced by the needle. Density profile was accomplished by using a densitometer (Wellhofer, WP102) with a spatial resolution of 0.8-mm. The profile was then fitted to a model of the two Gaussian functions. One is for the radiation field profile, the other for a dip caused by the narrow hole. The difference between the centers of the two Gaussian functions defines the deviation of the beam accuracy from the mechanical center of the unit. The deviations for x, y and z directions from one of our annual measurements are 0.05-mm, 0.05-mm, and 0.23-mm, respectively. The combined deviation is 0.24-mm, which is well within the specification and in excellent agreement with the results from the manufacture's laser measurement. This technique provides a simple, accurate and practical tool for measurement of the beam accuracy in the acceptance test and annual quality assurance of the Leksell Gamma Unit.