AbstractID: 13731 Title: A Ratio-Test for Routine Electron Energy Check for Linear Accelerators

Purpose: The AAPM TG-40 report recommends that electron energies of linear accelerators be checked monthly for constancy. The goal of this work is to develop and implement a method for routine energy check for megavoltage electron beams.

Method and Materials: The method is based on a percentage depth ionization (PDI) ratio-test equivalent to 2%/2 mm deviation from the original electron energy. Two PDI curves are generated for the beam of each energy by shifting the original PDI curve by ±2 mm. The upper and lower limits of ratio are computed by taking the PDI at two different depths from the two shifted curves. These ratios are measured monthly for each electron energy in solid water phantoms. Monte Carlo simulations are performed to find the shift in energy which may produce a deviation of 2%/2 mm in the percentage depth dose (PDD) or PDI at the given depths.

Results: The method is implemented in our clinic since September of 2008. We have results for 4 Varian and one Siemens Linacs. The ratio of PDI values falls within the allowed range consistently. For most Linacs the energy remains in a region narrower than the bounds of the allowed upper and lower limits. The position of this narrow range is determined by the energy set at the time of commissioning. The difference in the energy shift equivalent to a dose difference of 2% or a spatial shift of 2 mm differs for different energy beams. This is consistent with the well known relation between the mean energy and the depth of 50% ionization: $E_0=2.33R_{50}$.

Conclusion: The implementation of the ratio method of checking electron energy shows that it is a viable and relatively simple method to perform routinely.