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## Abstract

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## Multi Leaf Collimator Transmission Factor and Dosimetric Leaf Gap Measurements Using Calibration Unit Values from Integrated Images

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### Abstract

**Objectives:**

The intensity of the radiation delivery in a therapeutic linear accelerator (LINAC) can be controlled using Multi-leaf Collimator (MLC). Almost 80 to 160 leaves of different thicknesses are used for controlling radiation intensity. So, the intra-leaf transmission factor should be determined accurately. Due to the round-leaf-end effect, there is some Dosimetric Leaf Gap (DLG) and it also should be measured. The determination of these two parameters is the crucial part of the commissioning of the treatment planning system (TPS) and making precise radiotherapy planning like SBRT or SRS. Due to the unavailability of an exact method for the determination of MLC transmission and DLG, traditionally we use a water phantom or solid water phantom with a farmer-type ionization chamber. In this research project, we tried to find out the simplest way of determining the transmission and DLG simultaneously in the shortest time.

**Methods:**

We measured all data using a Varian VitalBeam LINAC newly installed at TMSS Cancer Center, Bogura, Bangladesh, and used three major pieces of equipment in our experiment: an integrated Electronics Portal Imaging Device (EPID), a solid water phantom and a farmer-type ion chamber (Model: IBA FC65-P). 60 pairs of Millennium MLC were integrated with the LINAC and Eclipse™ TPS was also used to make the QA plan for 6MV and 10MV photon beams and to analyze the images. The measurements were taken at 5cm depth and by extrapolating the curve linearly to zero, the DLG value was obtained. Then a comparison was made with verified and established data.

**Results:**

As per Varian machine recommendation, the transmission factor will be less than 2% and DLG will be less than 2mm. But using EPID 1200 a-Si, we got the result of 0.9254 mm for 6MV and 1.12 mm for 10MV photon beams. In comparison with the results for the ionization chamber and EPID-based dosimetry, we observed that DLG deviation is 0.06 mm and 0.14mm and transmission factor deviation is 0.17% & 0.30% respectively for 6MV and 10MV photon. We compared our results with other published data of a multi-institutional survey for MLC parameters for IMRT and VMAT technique in Japan. Where they suggested the value of MLC transmission for the VARIAN TrueBeam machine is  $1.50\% \pm 0.05\%$  for 6MV and  $1.72\% \pm 0.06\%$  for 10MV photon energy. In our measurement, we got the value of 1.45% for 6MV and 1.69% for 10MV photon beam using a farmer-type ion chamber. But using EPID 1200 a-Si, we got the result of 1.62% for 6MV and 1.99% for 10MV photons.

**Conclusion(s):**

The deviation between published data and our measured data for MLC transmission is within the limit for ion chamber-based results and it is a little bit higher for EPID-based results which is not negligible but does not affect much in the dose calculation.