AbstractID: 3862 Title: Systematic Approach for Predicting DMLC Motor Failure: A Prognostic Strategy

Purpose: Dynamic MLC and segmental MLC are the two competing delivery modes for IMRT plans. Each has its merits and limitations. Dynamic MLC provides a higher temporal resolution and more accurate dose delivery. However, it exerts extra stress on MLC driving motors, leading to a high motor failure rate. This stems from frequently alternated leaf acceleration and deceleration. The excessive heat generated by high instantaneous torque of the driving motors eventually leads to motor failure. This is particularly true for complicated head and neck cases, where many irregularly-shaped critical structures are involved and steep dose gradients are required. Frequent machine down-times create serious logistical problems and delay patient treatment. In this study, an attempt was made to decipher the DMLC motor failure pattern and design a practical prognostic strategy.

Method and Materials: A new VARIAN CLINAC 21EX was installed in our center in June 2004. Each evening, a “stress-test” DMLC file was run at gantry angles 0°, 90°, 180°, and 270°. This procedure was repeated after MLC reinitialization. All Dynalog files recording the leaf positions were saved for postprocessing. The “stress-test” file was created to intentionally “exercise” the leave at high speed so that those “sick” leave could be identified. The Dynalog files were then analyzed using ARGUS IMRT software. Based on our past seven months’ data, a prognostic most probable motor failure threshold was established.

Results: The motor failure patterns in terms of leaf position RMS errors were diverse, complicated, and disease site specific. An RMS value of 0.15 cm could be a good prognostic index for potential motor failure. However, “false positive” cases could still occur.

Conclusions: The prognostic strategy presented here is practical and easy to implement. However, a large sample of failed motors is needed to further validate the established threshold.