

AbstractID: 4744 Title: Application of Statistical Process Control to IMRT Quality Assurance

Purpose: An investigation was undertaken to determine the efficacy of the application of statistical process control (SPC) methods to the quality assurance measurements for individual patients prior to the application of intensity-modulated radiation therapy (IMRT).

Method and Materials: SPC is a quality control methodology developed by industrial engineers. IMRT treatments were delivered using 6MV and 18MV x-ray beams produced by a medical linear accelerator equipped with a 120-leaf multi-leaf collimator. Treatment plans for delivering IMRT were computed for fifteen patients using a commercial treatment planning system. A “phantom plan” was calculated for each patient. To compute the “phantom plan”, the patient’s virtual simulation CT data set was replaced by a CT scan of an ellipsoidal water equivalent phantom. The dose distribution was recomputed using the machine parameters that had been computed for the patient. Measurements of dose were made using a calibrated 0.2 cc Farmer-type ionization chamber in the water equivalent phantom. The dose was delivered using the same computer files that were to be used for treating the patient, and exactly the same medical linear accelerator parameters. The dose measured at points in the phantom was compared with the dose computed at the same points in the “phantom plan”. The dose differences were analyzed using the methods of SPC. For each patient a sample size of 2 was used. SPC Charts were constructed for the remaining ten patient cases employing the control limits derived from the first five cases. Additional studies of the performance of SPC were made using measurements with controlled errors introduced into the treatment delivery.

Results: The patient cases remained in statistical process control. Addition measurement demonstrated that the SPC graphs detected intentionally introduced errors.

Conclusion: Statistical Process Control is a practical technique for analyzing the patient specific quality assurance data for IMRT.