AbstractID: 12621 Title: An Accurate Mechanical Quality Assurance Procedure for a New High Performance Linac

Purpose

T o establish QA procedures for the mechanical systems of a new linac that has been developed to deliver radiation, using image-guidance, to the target with improved spatial accuracy. The procedures are required to be able to detect mechanical errors of much less than 1 mm, be independent of the linac's own readouts and calibration procedures, and be fast enough for the physicist to perform on a monthly or more frequent schedule.

Method and Materials

In image guided delivery, mechanical properties that will affect the spatial accuracy with which dose is delivered include:

- radiation isocenter –imaging origin displacement,
- position errors of the jaws and MLC leaves,
- accuracy with which the patient support couch can respond to a change in position request.

To measure these quantities, we use the machine's kV, MV, and infra-red imaging systems. We report on the techniques used, and the estimates of their accuracy.

Results

The preliminary estimate of the measurement uncertainty of the radiation isocenter – imaging origin offset is ± 0.3 mm. The observed offset is within the measurement error. The accuracy of the field size seen in the MV images is ± 0.2mm. Couch accuracy for shifts of up to 2 cm, the magnitudes expected using image guidance, was found to be within the measurement error.

The ability to control the machine using scripts allows gantry and collimator positioning, couch positioning, beam delivery and imaging in all modes, to be sequenced and performed automatically. Thus the time required for a complete mechanical QA procedure is greatly shortened.

Conclusion

The imaging components of a new linac can be positioned with sufficient reproducibility and accuracy to allow their use in a mechanical QA program that can achieve the sub-mm accuracy needed for this machine.

Research supported by Varian Medical Systems