AbstractID: 3601 Title: Measurement of Shielding Requirements for Helical Tomotherapy

Purpose:
Helical tomotherapy is a CT-based rotational delivery technique that uses intensity-modulated fan beams to deliver highly conformal intensity modulated radiation therapy (IMRT). The purpose of this work is to directly measure and map the radiation environment around a clinical TomoTherapy HI-ART system during patient treatments to determine the rate of in-room exposure.

Method and Materials:
Radiation exposure was measured at various positions surrounding a helical tomotherapy treatment system using a calibrated InoVision Model 451P ionization chamber. The 451P has a 300 cubic centimeter collecting volume air ionization chamber that is pressurized to 8 atmospheres (862 kPa). Prior to use in this study, the chamber was calibrated by an Accredited Dosimetry Calibration Laboratory (ADCL) and is directly traceable to the National Institute of Standards and Technology (NIST) standard.

Results:
A total of 225 measurements were taken during helical treatment delivery for 25 patients at various positions around the HI-ART gantry. The largest measured exposure rate is 1 mR/sec in the plane of gantry rotation from head leakage and primary beam transmission through the beam-stopper. There are 2.2 million seconds of beam-on time annually assuming an average beam-on time is 300 seconds, an average treatment slot of fifteen minutes, and patients per hour. Based on the measured scatter and leakage values, a total of 3 to 5 TVLs of secondary beam shielding is required, depending on the room geometry, patient load, occupancy factors, and dose limits.

Conclusion:
Based on the primary, leakage, and scatter exposures measured around the HI-ART it is possible to replace a conventional linear accelerator with a helical tomotherapy system without requiring additional primary or secondary shielding.