

AbstractID: 5359 Title: Comprehensive Cyberknife QA-A 2 year experience

Purpose: The 6MV X-band robot mounted linac in a CyberKnife(CK) system is more compact and maneuverable than conventional S-band linacs. Long term mechanical and radiation output stability of this linac is crucial for the sub-millimeter accuracy needed for stereotactic radiosurgery (SRS). The versatility of the CK allows for both extracranial and intracranial SRS use. The synchrony system tracks patient breathing thereby enabling precise irradiation of moving tumors. We evaluate the mechanical and radiation stability of the CK and the targeting error of synchrony with respect to variations in simulated anterior-posterior(AP) motion using a ball-cube phantom inside which gafchromic film is orthogonally positioned.

Methods and Materials: CK output is monitored by a vented chamber unlike a sealed chamber used in conventional linacs. A daily calibration factor(CF) is obtained to correct for the changes in temperature, pressure and output. Absolute output, flatness, symmetry penumbra, End-to-End and Iso-post tests are done monthly to verify the accuracy of the dose distribution and alignment of the X-ray tube and detectors respectively. A 2D motion platform was fabricated to simulate respiration. The amplitude of motion ranged between 1cm and 3cm, a dose of 3000cGy from a 3 path fiducially tracked plan were given to the phantom at the 62% iso-dose line. The films were analyzed using End-to-End software and the total targeting error in the AP direction was determined.

Results: Over two years of clinical use the linac output variation decreased steadily from 2% to below 1% while flatness, symmetry, and penumbra were well within CK specifications. The averaged CF was 1.011 ± 0.008 MU/cGy, the static targeting error was 0.8 ± 0.047 mm and the synchrony targeting error was 1.63 ± 0.056 mm.

Conclusion: We conclude that the CK mechanical system delivers the required targeting accuracy in both synchrony and static treatments, while the radiation instability is less than 2%.