AbstractID: 1941 Title: Investigation of megavoltage beams and detectors for electronic portal imaging

Accuracy of dose delivery in external beam radiotherapy is usually verified with electronic portal imaging (EPI) in which the treatment beam is used to check the positioning of the patient. However the resulting megavoltage x-ray images suffer from poor quality. The image quality can be improved by developing a special operating mode in the linear accelerator. The existing treatment beam is modified such that it produces enough low-energy photons for imaging. In this work the problem of optimizing the beam/detector combination to achieve optimal electronic portal image quality is addressed. The linac used for this study was modified to produce two experimental photon beams. These beams, named Al6 and Al10, were non-flat and were produced by 4MeV electrons hitting aluminum targets, 6 and 10mm thick respectively. The images produced by a conventional EPI system (6MV treatment beam and camera-based EPID with a Cu plate & Gd_2O_2S screen) were compared with the images produced by the experimental beams and various screens with the same camera). The contrast of 0.8cm bone equivalent material in 5 cm water increased from 1.5% for the conventional system to 11% for the combination of Al6 beam with a 200mg/cm^2 Gd_2O_2S screen. The signal-to-noise ratio calculated for 1cGy flood field images increased by about a factor of two for the same EPI systems. The spatial resolution of the two imaging systems was comparable. This work demonstrates that significant improvements in portal image contrast can be obtained by simultaneous optimization of the linac spectrum and EPI detector.