

Purpose: To acquire megavoltage portal images for radiation therapy verification with less than 1 MU.

Method and Materials:

Portal images were acquired using the 6 MV beam from a Varian 2100 EX accelerator and a prototype Varian 4030HE electronic portal imager (EPID). The EPID has an 8mm thick, pixelated CsI scintillating layer, allowing good quality images with less than 1 MU. A synchronization circuit reduced the dose to one beam pulse/image (up to 30 images/s can be acquired). Image noise was improved by averaging several images. We acquired images of an aluminum contrast-detail (Las Vegas) phantom and calculated the contrast-to-noise ratios of the indentations in it. The noise inside an open field was plotted as a function of the number of averaged frames. We also acquired weekly gated orthogonal localization images of the thorax for five lung cancer patients for physician review.

Results: Good quality images were acquired with an average of 10 one-beam-pulse images, corresponding to 0.3 MU. The CNS of the portal images of the Las Vegas phantom using the 4030HE and 0.3 MU was as good as that using the aS500 and 4 MU; the noise levels in the open field were also the same. Image quality and discernibility of of anatomic features in the patient images were deemed by the physician to be comparable to those from a standard 4MU portal image.

Conclusion: The new EPID can produce portal images with the same quality as the aS500, with a fraction (0.3 MU) of the dose conventionally used (usually 4 MU/image in our department). The imager also works with the Varian RPM respiratory gating system, allowing us to acquire gated portal images for verification of respiratory gated radiotherapy. This work was supported in part by U.S. National Institutes of Health grant P01-CA59017 and by Varian Medical Systems.