

AbstractID: 7661 Title: Verify intensity modulated radiotherapy (IMRT) beam delivery using the frame-averaging mode of amorphous silicon (a-Si) electronic portal-imaging device (EPID)

We investigate the frame-averaging mode of aS500 EPID for real-time verification of IMRT beam delivery. In this mode, the EPID continuously acquires and averages frames during the irradiation, and returns an averaged image, which is effectively the integral of the entire IMRT treatment. We acquired EPID images with the 15 MV beam of a LINAC using the standard setting of 0.111 s/frame (with EPID acquisition synchronized with LINAC beam pulses). The nominal LINAC output of 300 MU/s is reduced by the EPID servo to 272 MU/s. The reading of each EPID pixel is converted to dose and multiplied by the number of frames. We compare the measured and intended profiles using a linear regression method that returns an index σ for goodness of fit. We identified several errors that cause up-to 5% discrepancy in the measured dose, including a detector dead time of 0.27 s for every 64 acquisition frames (*i.e.*, $\approx 4\%$ correction factor), plus $<0.5\%$ error caused by EPID memory. Our results indicate that frame averaging is not affected by the variable dose rate inherent to IMRT beam delivery. When the errors are properly corrected, the measured dose is linearly correlated with the ionization-chamber measurement (slope ≈ 1.0 , $R^2\approx 1.0$). The measured profiles and CAX dose for 25 tested IMRT fields agree well with the intended profiles (mean $\sigma=1.9\%$, SD=0.5%) and CAX dose (mean measured/intended dose=1.002, SD=0.002), respectively. In conclusion, the frame averaging is very promising for real-time IMRT verification. Although the applied correction is satisfactory, a significant reduction of detector dead time is strongly preferred.