Purpose:

The primary objective of this study was to explore the possibility of using the exit detector data (EDD) for in vivo quality assurance of our clinical breast cancer patient (BC) treatments.

Methods:

Eleven clinical BC patients were evaluated for dose delivery accuracy using TomoTherapy's Delivery-Verification software on a GPU platform. Evaluations consisted of reconstructed delivery verification sinogram (DVS) and subsequent dose computation on MV-CT datasets. The DVS reconstructions and dose computations were calculated utilizing MV-CT scans covering the complete length of the treatment volume and the EDD files collected on the same day. Leaf-opening-time (LOT) differences were analyzed to investigate the frequency and magnitude of the sinogram differences between planned and reconstructed. Reconstructed dose distributions of fraction-deliveries were scaled and convolved to give an approximation of the composite dose distributions. Composite dose distributions were compared against the original plans. Summed doses were based on rigid-registrations of the fraction-doses and do not account for soft-tissue and dose deformations. Reconstructed DVHs are based solely on planning structures.

Results:

Characteristic average LOT differences were ~5msec-eq. It can be noted that large differences between individual fractions are small for composite dose distribution. For the reconstructed summed fractions, both minimal dose (D99%) and dose inhomogeneity (D5%-D95%) of the PTV were found to be within ±0.8Gy of the planned. Ipsi-lateral lung volume receiving >20Gy and contra-lateral lung volume receiving >5Gy were decreased by 0.5Gy%±0.4% and 3.2%Gy±1.9%, respectively. The heart mean dose and volume receiving >35Gy were decreased by 0.3Gy±0.4 and 0.3%Gy±0.3%, respectively.

Conclusion:

The results of study indicate that the EDDs are useful for DVS reconstruction and dose computation which can translate into being a great tool for in vivo quality assurance of BC treatments. Currently further studies are being investigated to account for the deformation of soft-tissue and dose distributions.