AbstractID: 12679 Title: The Optimal Frame Rate for Cine EPID Images

Purpose: To determine the patient-specific optimal cine EPID image acquisition parameters for intra-fraction organ/tumor motion monitoring.

Method and Materials: EPID images acquired in cine mode can provide verification of patient-setup and monitor internal organ motion during actual treatment without additional dose to the patient. This is especially useful when respiratory motion is of concern. The acquired EPID images are analyzed retrospectively with each image given equal weight for delivered dose estimation, thus it is important that they accurately represent the tumor locations throughout the treatment. 100 MU's were delivered to a phantom simulating patient breathing at 15 breaths-per-minute (BPM). Respiratory motion is in superior-inferior(SI) direction, and its position is recorded at intervals of 0.1, 0.5, 0.8, 1, 1.3, and 2 seconds, corresponding to 40 frames-per-breath(FPB), 8FPB, 5FPB, 4FPB, 3FPB, and 2FPB, respectively. Counts of recorded positions are plotted against the relative excursion (i.e. position divided by the amplitude of waveform) at bin size of 0.25. A frame rate of 10Hz (40FPB) is the intrinsic maximum limit of the device and is impractical due to processing speed and storage space limitations but provides a reference case. The optimal frame rate mimics the average excursion of the reference case and is independent of phase delay.

Results: Results from 5FPB generated the average excursion closest to 40FPB case and are less dependent on the phase, hence more preferable. Interestingly, at 2FPB, when the EPID images are acquired in sync with patient breathing, only the center position is recorded and the entire excursion is missed.

Conclusions: Cautions need to be taken when choosing the frame rate of EPID images so they represent the excursion of the tumor throughout the treatment. It is recommended to acquire images at a minimum of 5FPB.