Purpose/Objective: This study aimed to investigate the magnitude of interfraction prostate bed motion and delineate reasonable CTV-PTV margins in situations where image-guided localization is performed using an analysis of bony anatomy landmarks or gold seed fiducial markers and in situations where image-guidance is applied more sparsely and patient setup is done according to patient’s skin marks. Materials and Methods: Thirteen prostate cancer patients, who had been implanted four gold seed fiducials into their prostate bed, were imaged daily by cone beam CT (CBCT) before radiotherapy. In total, 466 CBCT images were analyzed and total position error, set-up error and prostate bed motion were measured by analyzing the position of gold seed fiducials and locations of bony anatomy landmarks. Systematic and random errors were calculated and CTV-PTV margins were determined for the situation where (1) the fractions are delivered according to patient’s skin marks, 2) the IGRT is performed for the first three treatment fractions, whereas the rest of the fractions are delivered according to patient’s offset skin marks, and 3) the IGRT is executed daily and the localization is based on bony anatomy landmarks.

Results: CTV-PTV margins were 4.9 mm in the left-right (LR) axes, 8.0 mm in the superior-inferior (SI) axes and 7.4 mm in the anterior-posterior (AP) axes when the localisation was done aligning to skin marks (i.e. without the IGRT). If imaging was performed on the first three treatment fractions and the rest of the fractions were treated according to patient’s offset skin marks, the margins were 2.4 mm, 6.5 mm and 6.6 mm in the LR, SI and AP axes, respectively. Prostate bed motion seems to have a relatively more significant impact to the SI and AP margins when compared to set-up error, which has more important role in the LR margin. The alignment of bony anatomy landmarks on daily basis does not reduce margins significantly hence it is reasonable to use imaging more sparsely in that case. In daily IGRT either the use of CBCT or the gold seed fiducial localization seems profitable.

Conclusions: Daily pre-treatment CBCT can reduce CTV-PTV margins for up to 33%, 26% and 23% in the LR, SI and AP axes, respectively. Prostate bed motion seems to have a relatively more significant impact to the SI and AP margins when compared to set-up error, which has more important role in the LR margin. The alignment of bony anatomy landmarks on daily basis does not reduce margins significantly hence it is reasonable to use imaging more sparsely in that case. In daily IGRT either the use of CBCT or the gold seed fiducial localization seems profitable.