Abstract ID: 17034 Title: A method to improve cone beam CT image quality and Hounsfield Units accuracy for prostate proton treatment planning

Purpose:Cone-beam CT provides 3D anatomical images which could be utilized for adaptive proton therapy. However, CBCT imaging artifacts produces inaccurate Hounsfield Units (HU) that might severely impair its application in proton planning. Specially, the uncertainty of the beam range might increase do to this HU inaccuracies. The goal of this study is to develop a methodology to improve CBCT HU accuracy as it relates to proton planning for prostate cancer patients.

Methods:In-house MATLAB routines were created to correct for HU in CBCT. CT and CBCT images were acquired at different lateral, longitudinal, and vertical positions for both, a water phantom and Catphan 504 heterogeneous phantom to evaluate uniformity and HU non-uniformity, respectively. Then, CT and CBCT images were acquired for a pelvis phantom and for prostate cancer patients. The Matlab routines were used to correct for CBCT global shifts in HU and contrast in these images. Finally, the results were compared and the HU corrections were evaluated

Results:Uniformity and contrast in CBCT images were corrected. For example, the HU values decreased at a rate of 30HU/cm in the raw CBCT vs. 16HU/cm along the lateral direction for the processed CBCT image for high density objects. The contrast increased around 25% and 30% between fat/soft tissue and soft tissue/bone, respectively, at the periphery of prostate patients. For example, the femoral heads bone goes from 729 in CBCT to 813 in processed CBCT while in the CT image it is 916HU. This is a 9% increase in accuracy(from 80% to 89%).

Conclusions:The potential of CBCT to be used for adaptive proton treatment planning for prostate patient has been investigated. Because inaccuracies of HU are predictable, Cone Beam CT images can be processed to yield accurate enough dose distribution for proton planning.