Abstract Submitted
for the APR21 Meeting of
The American Physical Society

High-resolution Quantitative Bone Imaging Using Cone-beam Ct with Scintillator-based Cmos and Amorphous Silicon Flat-panel Detectors[1] GENGXIN SHI, Johns Hopkins Univ, Dept of Biomedical Engineering, FERNANDO QUEVEDO GONZALEZ, RYAN BREIGHNER, Hospital for Special Surgery, WOJCIECH ZBIJEWSKI, Johns Hopkins Univ, Dept of Biomedical Engineering — We compare quantitative imaging of bone microstructure using two high-resolution orthopedic Cone-Beam CT (CBCT) systems: (i) a prototype CMOS-based scanner with 99 um pixel size, custom 400 um thick CsI scintillator, 140 e- electronic noise, and 17 sec scan time vs. (ii) a conventional aSi flat-panel-based scanner with 137 um pixel size, 700 um thick CsI, 2000 e- electronic noise, and 60 sec scan time. Based on these specifications, CMOS-CBCT is anticipated to provide improved performance in in vivo high-resolution imaging tasks, such as structural and topological assessment of trabecular bone. 26 bone cores from human proximal and distal cadaveric tibias were imaged with both CBCT systems (100 um voxels) and with gold standard micro-CT (30 um voxels). Bernsen segmentation was used for trabecular binarization in CBCT. We investigated the sensitivity of trabecular metrics to CBCT spatial resolution and to the settings of the Bernsen algorithm. Initial results indicate that for a segmentation setting where both CBCT systems achieved similar correlations in bone volume fraction against gold-standard micro-CT, the CMOS-CBCT yields slightly better correlations than aSi-CBCT for trabecular spacing (TbSp), thickness, and number (e.g. TbSp=0.76 for CMOS-CBCT vs 0.7 for aSi-CBCT).

[1]Partly supported by NIH R01 EB018896.

Gengxin Shi
Johns Hopkins Univ, Dept of Biomedical Engineering

Date submitted: 11 Jan 2021 Electronic form version 1.4