AbstractID: 9608 Title: Improving the Accuracy of Optical-Emission-CT Imaging Through Application of a Non-Uniform Attenuation Correction

Purpose: Optical computed tomography (optical-CT) and emission tomography (optical-ECT) are new techniques with demonstrated potential for imaging structure and function (including gene expression) in unsectioned tissue samples. This work presents the first attempts to improve the accuracy of optical-ECT by incorporating an attenuation correction analogous to that applied in SPECT. **Method and Materials:** Optical-ECT can be described as a linear system Ax=b, where x is the fluorescing distribution, b is the expected value of measured projections, and A describes the mapping from x to b. An in-house code (*Spect-Map*) originally developed for SPECT reconstruction was adapted for application to optical-ECT. Verification of the method was performed by imaging a phantom containing a known distribution of fluorescing wires. Optical-CT/ECT projections were taken consecutively to ensure accurate co-registration. Attenuation-uncorrected and -corrected optical-ECT images were reconstructed by calculating A assuming zero attenuation and the optical-CT-measured non-uniform attenuation, respectively. Successful preliminary verification led to the application of attenuation correction to optical-ECT images of unsectioned human breast xenograft tumors which had transcribed fluorescing proteins labeling viable tumor burden (RFP) and HIF1 distribution (GFP). **Results:** Significant attenuation artifacts were observed in the uncorrected optical-ECT image of the phantom. The middle wire appeared artificially less intense due to greater attenuation from the surrounding ink-doped gel. This artifact was successfully removed in the attenuation-corrected image, demonstrating basic performance of the method. Fluorescence intensities of the wires varied by as much as 29% in the uncorrected image versus 3% in the corrected image. Application of the attenuation correction to xenograft tumor images shows significant changes in apparent expression of fluorescing proteins. Interpretation and results will be presented. **Conclusion:** These results suggest that *Spect-Map* has been successfully adapted to perform attenuation correction for optical-ECT imaging. Preliminary xenograft tumor reconstructions indicate that attenuation correction is vital for accurate optical-ECT imaging.