AbstractID: 13490 Title: Real-Time Laser Source Tracking for Pleural PDT Treatment Planning System

Purpose: One of the most important factors determining PDT efficacy is the spatial homogeneity of light fluence rate distribution. This light uniformity requirement is especially important for treatments involving cavities, where light source moves in real-time. For non-small cell lung cancer, PDT has proven to be effective but its efficacy depends on the uniform light delivery to the pleural surface, which relies solely on the surgeon's balanced movement of the laser source. This study therefore aims to develop a real-time dosimetry system capable of ensuring homogeneous light fluence delivery for pleural photodynamic therapy (PDT).

Method and Materials: An infrared camera system is used to track the laser source real-time during PDT. Camera control and data acquisition software is developed using IGSTK. An inner surface contour is established as the boundary of the treatment area, to which the PDT dose is determined. Registration of the inner surface contour to pre-surgical CT is used to monitor PDT dose to surrounding critical organs.

Results: Inner surface contour of a phantom cavity is delineated and the accuracy of the system is determined to be <2mm. Real-time tracking during PDT procedure is also demonstrated. No interference between the treatment laser and the IR tracking system is observed. The total time required to establish the inner surface is less than one minute.

Conclusion: We showed that the movement of the surgical laser source can be tracked real-time and recorded throughout the PDT treatment session. Developments are currently underway to utilize this 3D position information for real-time dose calculation. Light fluence rate deposited into the pleural cavity will be quantitatively determined and displayed real-time for the operating surgeon. With this real-time visual guidance, the surgeon will be able to move the laser wand in such a way that ensures dose homogeneity and thus better PDT efficacy.