

## **Computer simulations driving improved implementation of Optical Projection Tomographic Microscopy**

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Lung cancer is the leading cause of cancer related deaths worldwide with approximately 1.37 millions deaths per year. In July 2013, the U.S. Preventative Services Task Force approved low-dose Computed Tomography (CT) for early detection of lung cancer in heavy smokers, however its potential implementation is hindered by safety concerns due to its use of radiation and its overall cost to the healthcare system. Low-dose CT is also only capable of detecting masses greater than 2mm in diameter, which could hinder physicians ability to detect and effectively treat the cancer.

In an effort to perform early detection before masses are visible, VisionGate Inc. is developing a microscope based on Optical Projection Tomographic Microscopy (OPTM) to detect cancer at the cellular level. OPTM reconstructs three-dimensional images of single cells from projection images acquired from different perspectives around the cell. This presentation will provide an overview of efforts performed in our lab to develop a computer simulation of OPTM. This simulation is designed to analyze all aspects of OPTM image formation, such as degree of specimen staining, refractive index matching, and objective scanning. The computer simulation is used in conjunction with experimental methods to refine conclusions and improve system design in a robust methodology.

While this work is currently driving improved microscope design, in the long term it will provide a framework to develop quantitative microscopy where pixel values are directly related to cellular optical properties. These improvements will provide improved sensitivity and specificity for early detection and ultimately reduce lung cancer mortality. These benefits will be further bolstered by its ability to mitigate the impact of cost and radiation concerns inherent in low-dose CT screening.