Abstract Submitted
for the SES07 Meeting of
The American Physical Society

Novel micromirrors to obtain three-dimensional images of cells[1]
CHARLES WRIGHT, ERIK BOCZKO, JOHN WIKSWO, KEVIN SEALE, Vanderbilt University — Confocal scanning laser microscopy and multiphoton microscopy provide 3D data from biological specimens, but with limited z-axis precision. We are developing a system which uses multiple microscale mirrors to obtain more accurate 3D data on living cells while using classical widefield microscopy. Etched silicon wells coated with aluminum have been used to obtain 3D images of pollen grains and protozoa. Because the sides of the well are angled, reflections along these planes provide information along the z-axis, and a back-projection algorithm can be used to reflect the data points to reconstruct a 3D image. We are currently optimizing the system to make measurements of the volume of an individual budding yeast cell as it progresses through the cell cycle. Due to the roughly prolate spheroidal shape of the yeast cell, data from this organism are suitable for fitting to a simple 3D surface, and integration provides the volume of the cell over time. The mirrored silicon wells can also be coupled to a microfluidic device to allow for measurements of 3D data for cells in traps. In addition, we are forming a mirrored well on the end of an aluminum rod which can then be positioned optimally above a cell, obviating the need for the cell to sit within the well.

[1]Supported by NSF, VIIBRE, and SyBBURE.

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Date submitted: 20 Aug 2007 Electronic form version 1.4