ABSTRACT
UCSB, in association with the Soh laboratory, is currently involved in cutting edge microfluidic research. In order to produce these high end microfluidic devices, researchers have to accurately and precisely drill holes in silicon wafers and glass microscope slides by utilizing a bench top CNC mill. Because these microfluidic devices require such high precision drilling, a time-intensive set up procedure is essential for optimal results.

Team 19’s project set out to minimize this initial set up time by improving the old system in three categories:
1. Replacing a cumbersome microscope with a sleek high resolution camera
2. Updating existing coordinate transformation software via LabVIEW
3. Design a new vacuum chuck with replaceable top plates that could accommodate both circular silicon wafers and standard 3 x 1 inch microscope slides

TESTING AND ANALYSIS
Design requirements were verified by testing and analyzing our prototypes and final design. Robustness and ease of use were among the priorities for design. Below is a list of tests done to verify the end product met the design specs.
- Time Trials- Before upgrade 15min avr. After 7.53 min avr.
- Lateral Clamping Force- Chuck had average 7.04 lb force
- Natural Frequency (Stand)- Maximum 25.6 Hz < 168 Hz spec
- Vacuum Chuck Replacement Time- 4:21 min
- Camera Drift Test- 2.4µm, Much less than 250µm spec
- Auto Centering Measurement- 1.18 mm from center
- Power Outage Safety Test- Proved to be safe in power loss
- Camera Magnification- Found Magnification ranged from 1x – 200x

MODELING AND PROTOTYPING
The bulk of the modeling for this project consisted of the camera stand and new vacuum chuck. In both cases, the educational license of Solidworks 2012 was used in order to iteratively develop a suitable design for use in the final setup. The camera stand was originally designed to be both slender and robust, and then methodically underwent modeling changes as the design required improvements. Similarly, multiple changes were made to the vacuum chuck model in order to meet requirements, but also to overcome spontaneous obstacles. Engineering drawings were then produced using Solidworks, and eventually used to machine individual parts.

SOFTWARE
A major part of our project was to update the LabVIEW software used in conjunction with the upgraded system. The prior software was used to precisely locate the wafer and perform a coordinate transformation and a programming language change. This software offered no support for rectangular microscope slides, and posed additional challenges for the user that did not need to be as accurate when locating the wafer. The user was forced to place alignment marks on the wafer and go through an extended process to locate the wafer, when its approximate location would have sufficed. We added an option that allowed the user to perform a coordinate transformation without the need to place and find alignment marks, which will save the user a significant amount of time. The new user interface gives the operator 3 distinct options for coordinate transformation, and will greatly improve the ease of use for the CNC mill.

CONCLUSION
The implementation of the new system was a success. The overall required set up time prior to drilling was reduced by almost half. In addition, the improved software, vacuum chuck, and camera implementation has greatly improved the ease of use.

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REFERENCES
-Flashcut 4.0 User Manual
-LabVIEW 2010 User Manual